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[OFFICIAL NOTICE.]

July Meeting, Society of Gas Lighting.

OFFICE OF THE SECRETARY, July 3, 1896.

The July meeting of the Society of Gas Lighting will be held in Manhattan Beach Hotel, Manhattan Beach, Coney Island, at 3 P.M. of the 9th inst.

FRED. S. BENSON, Secretary.

[OFFICIAL NOTICE.]

Fourth Annual Meeting, Pacific Coast Gas Association.

OFFICE OF THE SECRETARY,
OAKLAND, CAL., June 10, 1896.

The fourth annual meeting of the Pacific Coast Gas Association will be held at the office of the San Francisco Gas Light Company, corner of First and Natoma streets, San Francisco, Cal., July 21st and 22d 1896. The headquarters will be in Parlor "C," Palace Hotel. The Secretary will be in attendance at headquarters from 10 A.M., Monday, July 20th. The sessions will be convened at 10.30 A.M. and 2 P.M. The following papers will be read:

"The Economy of Coals," by Mr. John L. Howard, San Francisco, Cal.

"The Relative Position of Consolidated Gas and Electric Light Plants," by Mr. M. C. Osborn, Santa Cruz, Cal.

"Oil Tar and its Uses," by Mr. J. B. Grimwood, San Francisco, Cal.

"Telescoping a Single Lift Holder while in Use," by Mr. J. L. Fogg, San Francisco, Cal.

"Gas Stoves," by Mr. D. Decker, Fresno, Cal.

"Municipal Ownership," by Mr. John A. Britton, Oakland, Cal.

"Evolution of a Gas Meter," by Mr. Chas. H. Dickey, Baltimore, Md.

"Wrinkles," edited by Mr. T. R. Parker, Napa, Cal.

"Experiences," edited by Mr. John Clement, Red Bluff, Cal.

"Question Box."

In addition to the papers mentioned, there will be an exhibition of acetylene gas and of the Roentgen rays during the progress of the meeting.

A meeting of the Board of Directors will be held at headquarters, Monday, July 20th, at 8 P.M. The annual banquet will be held in the Palace Hotel, at 8 P.M., of Wednesday, July 22d. Thursday, July 23d, will be devoted to the social part of the meeting, which is to consist of an excursion over the electric scenic road now being built to the summit of Mount Tamalpais. The Question Box is now ready for such questions as members may choose to propound.

JOHN A. BRITTON, Secretary.

BRIEFLY TOLD.

OUR SIXTY FIFTH VOLUME.—With this issue our sixty-fifth volume is started on its way, under circumstances and conditions that are satisfactory and stimulating. In the first place, despite the turmoil which exists in the ordinary commercial world over the attempts of possibly well meaning, but certainly misguided agitators to substitute a fallacy for a fact in respect of the monetary standard of the country, we have the satisfaction of knowing that the gas business to-day stands on a firmer footing than it ever had. Cold figures, well conned, show that the increase in sendout is now at the normal that existed prior to the falling off of 1893, and that the increase is not an ephemeral one we think is proven by the knowledge that the growth is not confined to any special section—all districts reporting advances, although the highest percentages are reported from Eastern territory. The record respecting plant enlargement and main extension is exceptionally interesting, in that the scope which it embraces or environs virtually includes every State; nor do these works betterments relate to the plants of the larger Companies alone. On the contrary, the preponderance of improvement really appears to concern the average size or even the smaller Companies, which is the best of stimulating testimony that gas is to remain the light of the masses. So we say our sixty-fifth volume opens under satisfactory and stimulating conditions, for as the state of

the gas business is, so is our temper and so is our hope. Meanwhile, we have only to say that we shall walk in the path over which we travelled for many years in safety, doing our best in all honesty and sincerity to serve the interests of the industry, the continued stability of which we never for a moment doubted, and never for a moment failed to uphold.

FIELD'S ANALYSIS FOR 1895.—Mr. John W. Field, the accomplished statistician whose annual compilation and "analysis of the accounts of the principal gas undertakings in England, Scotland and Ireland" is awaited by English gas men with quite as much eagerness as the average magazine reader awaits the publication in book form of a serial story of more than average merit, is early in the field this season with his records for 1895. When we have said that the book now before us is as accurate as all of its 26 predecessors (the current volume is the 27th), and that no detail has been omitted that should have been included, the whole story is told. A notable feature of the tables, which, however, can only be sifted out by quite a nice bit of calculation, is the important growth in the London district of the use of water gas for enriching purposes. The "Analysis" teems with figures eloquent of the vastness of the gas industry of Great Britain.

"THE STORY OF A PIECE OF COAL."—This is the title of the latest volume issued by Messrs. D. Appleton & Co., of this city, in their "Library of Useful Stories," the book being virtually an adaptation for the American market of its English predecessor, which is chargeable to the pen of Edward A. Martin, F.G.S., of Thornton Heath. The author treats his theme in a manner calculated to appeal rather to the thought of the average reader than to the study of the professional man or to the analyzing of a student; but while he confines himself to the coal itself, instead of detailing what comes of and by its working, he has put together in clever shape much that is worthy. Not so, however, is his sixth chapter, which is devoted to the telling of "How Gas is Made," etc. In this section of his story Mr. Martin is well astray; for he declares that, referring to the carbonizing of coal as the first step in gas making, the "retorts are huge cast iron vessels," etc. Still, as it is a popular "story," it matters little to the public whether the retorts are of iron or of clay, since their interest in gas is usually confined to a certain knowledge that their meter is fast—of meters Mr. Martin luckily says nothing. He is also widely astray in his reference to the danger, on sanitary account, of the presence of gas works in thickly populated districts; for although he mentions the harmfulness of the odors which arise from and about the purifying rooms of gas works, he has never a word about the numbers of parents escorting their children suffering from whooping cough, who frequently visit the "dangerous" purifying room on days when the boxes are being cleared of the foul material —when the odors certainly should be at their strongest. On the whole, however, Mr. Martin's story is well worth reading.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Cedar Rapids is in Line.

CEDAR RAPIDS GAS LIGHT COMPANY,
CEDAR RAPIDS, IOWA, June 30th, 1896.

To the Editor AMERICAN GAS LIGHT JOURNAL: The City Council of Cedar Rapids recently passed an ordinance extending the franchise of the Gas Light Company for 20 years, and fixing the price at $1.80 per 1,000 cubic feet, with a discount, if paid on or before the 10th of the month, of 20 cents for light. and 45 cents for fuel, or for fuel and light through the same meter—the latter discount being given only when 1,000 cubic feet or over are used per month. The Gas Company has accepted this ordinance, and the new rates go into effect to-morrow. It is a reduction of about 10 per cent from the old rates. One-half mile of 6-inch cast iron main will be laid to replace smaller sizes, and about two miles of extensions of 3-inch main are now being made. The increase of business during the past year, from Welsbach lights and gas stoves, has been so satisfactory that the Company has leased a fine room on the first floor (also basement, for shop) of the new Cedar Rapids Savings Bank Building, adjoining the Post Office and Government Building on Third street. This is a modern office building, is fireproof and centrally located. This room will be used for the display of gas stoves and Welsbach goods, as well as for office purposes. The Company looks for a very noticeable increase in sales, at $1.35 net for fuel, and a large extra force is now at work running services and setting stoves. Yours truly, GEO. F. GOODNOW, Supt.

Explosive Mixtures of Combustible Gases with Air, and Methods for Detecting and Measuring Minute and Dangerous Proportions of such Gases.

[A lecture by PROF. FRANK CLOWES, before the 33d Annual General Meeting of the Incorporated Gas Institute.]

Explosion of Combustible Gases.—Every combustible gas, when it is burnt in air, develops a certain amount of heat, and yields certain gaseous or vaporous products. The gas can only burn as air is supplied to it. Hence, if the gas is kindled at the mouth of a vessel, it will burn only where it comes into contact with the air. If, however, the gas has been mingled with air before being kindled, it may be enabled to burn rapidly throughout its mass, without obtaining a supply of air from outside.

When a mixture of combustible gas and air burns rapidly throughout its mass, the heat developed is stored for a time in the products. These products become increased in volume by the heat, and occupy a volume considerably larger than that of the original mixture of gas and air. Hence the kindling of such a mixture in the open gives a large flare, while in a confined space it produces pressure, and possibly explosion.

Those gases which create the highest temperature by their combustion will produce the greatest pressure or explosive effect when they are burnt in a state of mixture with air. One gas at least adds to the explosive effect produced by its combustion, that due to heat created by the decomposition which accompanies its combustion. This gas—acetylene—is therefore competent to produce unusually powerful explosive results.

It is noteworthy, and is easily demonstrated by experiment, that the cool products of explosive combustion of a mixture of coal gas and air occupy less space than the mixture did before its combustion. In the case of coal gas, the volume of the cool products is little more than three-quarters that of the original explosive mixture. This contraction of volume of the products in cooling is largely due to the steam which has been formed during the combustion condensing to water. Such a contraction occurs in the case of every combustible gas containing hydrogen as a constituent; and it is therefore a very general result.

Explosive Limits of Combustible Gases.—The proportion in which air is mingled with the combustible gas has very considerable effect upon the explosive nature of the mixture. When the gas is present in a certain proportion in the air, the explosive effect produced by kindling the mixture is a maximum. The explosive effect is lessened when this proportion of gas is either increased or diminished; and when the proportion of gas is increased or decreased to a certain extent or limit, the mixture cannot be kindled and burnt explosively.

The lecturer mentioned the upper and lower limits for certain important combustible gases. The lowest and highest percentages of each gas which were explosive in air were stated, as they had been fixed by his own experiments. The experiments were made with mixtures in varying proportions of each combustible gas with air. A flame was brought into contact with each mixture, sometimes above and sometimes below; and it was noted whether the mixture burnt back independently of the external air. For each combustible gas there was thus obtained a lower percentage, below which the mixture would not burn independently, and a higher percentage, above which the mixture burnt only when it was supplied with more air. The limiting percentages were as follows: For methane or marsh gas, 5 and 13; for hydrogen, 5 and 72; for carbon monoxide, 13 and 75; for ethylene, 4 and 22; for water gas, 9 and 55; for coal gas, 5 and 28; and for acetylene, 3 and 81. It was also proved that many mixtures which were outside, but close to the above limits, and which could not be fired from above, could be fired from below. Hence it is inferred—

1. That the limiting explosive mixtures for different combustible gases vary widely in composition.
2. That methane shows the narrowest limits and hydrogen the widest limits.
3. That the risk of a mixture being fired explosively increases with the different gases in the following order: Methane, ethylene, coal gas, water gas, carbon monoxide, hydrogen.
4. That the risk of explosion occurring is greater when the mixture is kindled from below than when it is kindled from above.

In the case of mixtures of Nottingham coal gas with air, which are exposed to contact with a flame applied beneath, explosive firing begins when 5 per cent. of gas is present; it reaches a calculated maximum with 14 per cent. of gas; and explosive firing ceases when 28 per cent. of gas is in the air. If, however, the kindling flame is applied beneath the mixture, explosive firing does not commence until 9 per cent. of gas

is present, and it ceases with 22 per cent. The coal gas used in these experiments was the Nottingham town supply. An analysis made by the lecturer at the time of its use showed that the gas contained the following percentages of its constituents :

Composition of Nottingham Coal Gas.

Olefine hydrocarbons	5.3
Oxygen	0.2
Nitrogen	5.5
Hydrogen	48.2
Carbon monoxide	6.6
Methane or marsh gas	34.2

The water gas was found to have the following percentage composition :

Composition of Water Gas.

Hydrogen	49.6
Carbon monoxide	40.8
Carbon dioxide	2.6
Nitrogen	7.0

This liability of mixtures of combustible gas with air to explode when they are kindled, constitutes a danger which is familiar to those who have to deal with coal gas and with the different forms of gaseous fuel. In order to guard against danger, it becomes necessary to watch carefully for escapes of such combustible gases into air spaces which are more or less confined, and especially to guard against all risks of such mixtures being kindled.

Poisonous Constituent in Coal Gas, Gaseous Fuel, and in the Products of their Incomplete Combustion.—But there is another danger besides the explosive force attendant on the burning of such mixtures. If the gases contain carbon as a constituent—as all ordinary illuminating and heating gases do—there is a possibility of the products of combustion or of explosion being rendered poisonous by the presence in them of carbonic oxide gas. This danger arises only when the combustion of the gas has been incomplete. Incompleteness of combustion may arise from deficiency of air or from contact of the flame with chilling or cooling surfaces. The consideration of danger from poisoning by breathing air containing carbonic oxide arises, however, not only in connection with the products of incomplete combustion of these gases, but also in connection with the gases themselves before they are burnt.

Water gas is highly poisonous when breathed ; it contains as much as 40 per cent. of carbonic oxide. Producer gas, Dowson gas and other gaseous fuels contain somewhat less of this poisonous gas ; but even coal gas, with about 6 per cent. of carbonic oxide, is poisonous, and becomes still more so when it has been enriched by the use of water gas.

Detection and Measurement of Carbonic Oxide.—Air may accordingly become poisonous by the escape into it of illuminating or of heating gas. Many of these gases possess no characteristic smell ; and their presence in the air would therefore not be evident to the senses. It is even stated that coal gas, which is usually readily detected by its smell, may be deodorized by its passage through certain kinds of soil, and might therefore be present in the air unperceived. Under these circumstances it often becomes necessary to be able to test for the presence of these gases in the air. A test for inflammable gases generally will be subsequently described. This test detects even the minute proportion of carbonic oxide in air which gives rise to danger ; but it does not serve to discriminate between the different kinds of combustible gas, many of which are not at all poisonous.

Dr. J. S. Haldane has, however, furnished a means of testing air for carbonic oxide, which is of easy application. With a little care it serves also to measure the proportion of carbonic oxide present in the air. It depends upon the fact that blood diluted with one hundred times its volume of water changes color from pale-brown to pink when it is shaken with air containing carbonic oxide. So small a quantity as 0.1 per cent. of carbonic oxide in the air may be detected and measured by properly applying this test. The full particulars of this method, and of the means of detecting inflammable gas, will be found in a book by the lecturer on "The Detection and Measurement of Inflammable Gas and Vapor in the Air," which is now in course of preparation by Messrs. Crosby Lockwood & Son.

Dr. Haldane finds that the presence of 2 per cent. of carbonic oxide in the air renders such air very poisonous, and rapidly fatal when it is breathed. The presence of even 0.2 per cent. produces symptoms of poisoning, and may, under certain conditions, prove fatal. Hence extreme care is necessary to avoid breathing, even for a short time, air mixed with much gas containing carbonic oxide. Dr. Haldane furnishes a ready means of obtaining a warning of danger arising from this source, when it is necessary to enter air which may have been poisoned by carbonic oxide. He suggests carrying a mouse in an open wire cage. The mouse is rendered prostrate and helpless by breathing air containing carbonic oxide in about one-twentieth the time required to affect a man. If, therefore, the mouse is seen to be affected warning is given in time to beat a retreat.

Hydrogen Flame-Cap Test for Combustible Gas.—Since coal gas or gaseous fuel is poisonous, and may be explosive when it is mingled with air, it is well to be able to detect its presence in air by an infallible test, and to measure, if necessary, the proportion which is present. If coal gas is smelt no certain knowledge of the proportion present can be formed. Most of the heating gases, apparently including coal gas under certain conditions, are free from smell. These could not even be detected, far less measured, by the senses.

Accordingly, a means of detecting and measuring firedamp, which was perfected by the lecturer some years since, has been adapted to the detection and measurement of lighting or heating gas in the air. This method is intended to take the place of certain tests depending upon physical and electrical principles. The physical methods depend on diffusion and on sound. They are untrustworthy, because their indications are disturbed, and even destroyed or reversed, by the presence of non-combustible carbonic acid, and by changes of pressure and of temperature in the air. The electrical methods are complicated, and are not usually applicable on the spot.

The flame-cap test has been made by various kinds of test flames. It is quickly and easily carried out on the spot where the test is required to be made ; and, in its best form, it is delicate and trustworthy. The flames used for the purpose have been at various times those of a common candle, a small oil lamp, and an alcohol lamp. Lately the lecturer has rendered possible the use of a hydrogen flame ; and the test thus carried out is of admirable delicacy and accuracy. The flame-cap test detects and measures proportions of combustible gas in the air which are too small to be detectable by kindling when a flame is applied.

When a flame is introduced into air which contains a proportion of combustible gas below the lower explosive limit, the gas burns as a pale halo or "flame-cap" above the flame. The burning of the cap is maintained by the heat of the flame. This flame cap is so pale that it is only seen in almost complete darkness. Hence it is not visible if the flame itself is bright and luminous ; and it is not visible in daylight. The hydrogen flame presents the advantage over all other test flames that it gives no light, and does not interfere with the perception of the flame-cap. It is also very hot, and therefore produces larger flame-caps than any other flame ; and it possesses great power of resisting extinction by carbonic acid and by air movements. It is, further, easily adjustable with precision to a set or standard height. This adjustment is of the greatest importance, because the flame-cap height is constant for the same proportion of gas if the test flame is always of precisely the same size. The cap height varies, however, with the varying height of the flame, and to a far greater extent than the flame itself does.

With a test flame which is always set to an invariable height, it is therefore possible, not only to test for the presence of combustible gas, but also to ascertain the percentage of inflammable gas which is present, by simply measuring the height of the flame-cap. Further, since the height of the flame-cap steadily rises as the proportion of gas in the air increases, it is possible to supply a scale which gives for each height of the flame-cap the corresponding percentage of gas present in the air, as is shown in the following table :

Percentage of Coal Gas in Air.	Corresponding Height of Cap in Inches. With Large Hydrogen Flame.	With Small Hydrogen Flame.
0.25	0.63	..
0.50	0.74	..
1.00	1.00	..
2.00	1.62	..
3.00	2.40	0.46
4.00	..	1.20
5.00	..	2.40

The flame-cap makes its appearance over the hydrogen flame when 0.1 of 1 per cent., or 1-1000th of inflammable gas is present in the air ; and therefore the test is a very delicate one. The cap is seen, and its height may be measured until the proportion of gas in the air reaches 5 per cent.—that is, until an explosive mixture is reached. An explosive mixture at once extinguishes the hydrogen test flame ; and the presence of an explosive mixture is also detected by the fact that it kindles and burns. Hence the standard hydrogen flame at once indicates

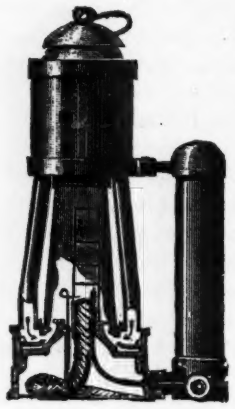


Fig. 1.—The Hydrogen Safety Lamp.

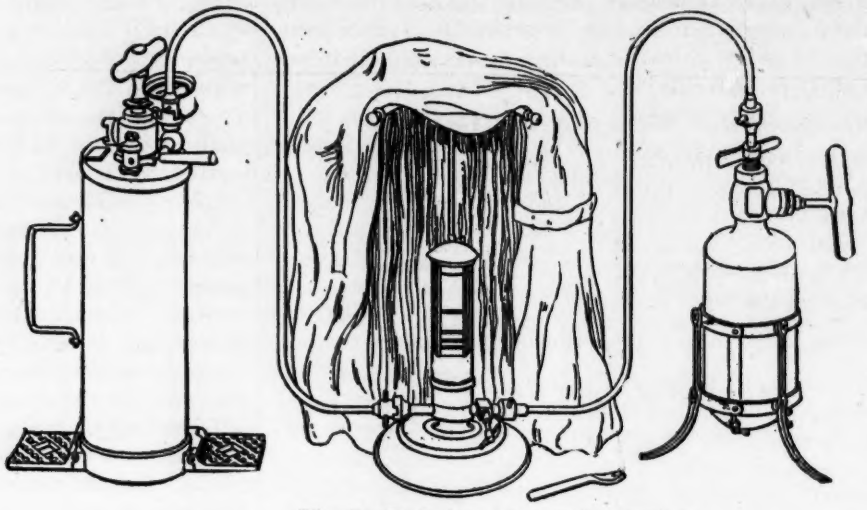
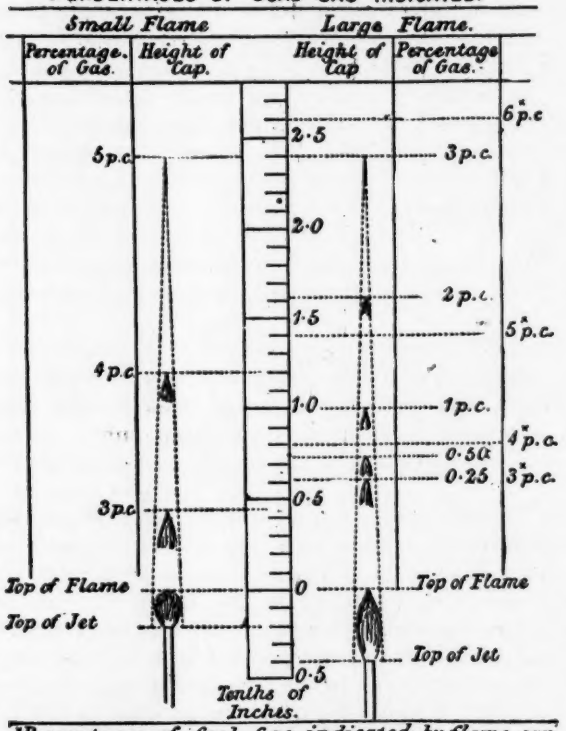


Fig. 2.—The Redwood Gas Testing Apparatus.

Fig. 3.—The Clowes-Redwood Portable Testing Apparatus. (Total weight, 11 lbs.)

STANDARD HYDROGEN FLAMES AND CAPS, WITH PERCENTAGES OF COAL-GAS INDICATED.



Percentages of Coal-Gas indicated by flame-cap heights over the reduced oil-flame

whether a mixture is explosive; and if the mixture is not explosive, it detects the presence of the combustible gas down to 1-1000th of the mixture. It further detects and measures any percentages of gas between 0.1 and 5.

Apparatus for the Application of the Hydrogen Flame-Cap Test.—The difficulty of supplying hydrogen gas for this test has been overcome by employing the gas compressed in steel cylinders, from which it is allowed to escape by means of an easily adjustable valve. In the early application of the test, the hydrogen flame was always burnt within a miner's safety lamp. The lamp could be introduced into an atmosphere which had to be tested for inflammable gas, without incurring any risk of firing or exploding any gas which might be present.

The testing lamp, in its most portable form, has a small light pocket cylinder attached to it. The supply of compressed hydrogen gas contained in this cylinder can maintain the standard hydrogen flame in the lamp burning continuously for more than two hours. The hydrogen passes from the cylinder through a copper tube traversing the oil vessel of the lamp; and it is kindled by the oil flame of the lamp, which is then extinguished by the "pricker," in the usual way. The hydrogen flame is set to standard height against a scale, and the height of the flame-cap is noted also against this scale. The gas cylinder is easily detachable from the lamp, and can be carried in the pocket. When it is attached to the lamp it serves as a convenient handle. A larger cylinder of gas may be carried slung from the shoulder, and may be connected by a flexible tube with the lamp. Larger cylinders still, which are not portable, may be used for stationary tests. They can maintain the test-flame for several weeks at a time. The hydrogen safety lamp was designed for detecting and measuring firedamp in the atmosphere of coal mines; but it serves equally well to test for and measure coal gas in air.

Mr. Boverton Redwood required an apparatus to test air for petroleum vapor in spaces which could not be safely entered, on account of the effect produced by breathing the vapor. He accordingly devised, in conjunction with the lecturer, an apparatus for collecting a sample of the air under pressure. This is seen on the left of the illustration, Fig. 2. This vessel may be connected with an apparatus shown in the center, in which a standard hydrogen flame is burnt; the hydrogen gas being supplied from a cylinder on the right. By this means a sample of air may be collected from any desired space, and may then be tested by means of the hydrogen flame for petroleum vapor. The amount of

such vapor which is present in the air can also be measured by the height of the flame-cap.

The hydrogen flame testing apparatus has recently been made in a very convenient and portable form. [See Fig. 3.] The collecting vessel is dispensed with, and the air is pumped direct from the space to be tested, over the test flame, by means of a valved india rubber ball, connected by a rubber tube below to the air space, and by a rubber tube above to the hydrogen flame apparatus. In order to make the apparatus more portable, the small pocket hydrogen cylinder is used, and the apparatus is mounted on a light camera tripod stand. The testing apparatus and the head are covered with a black cloth while the cap is being observed, precisely as is done in using a photographic camera. By a simple device, the standard flame may be adjusted to two different heights; and thus the whole range of coal gas testing from 0.25 to 5 per cent. may be rapidly carried out—the cap height measurements being converted into percentages of gas by reference to the scale already referred to.

This form of apparatus has proved most convenient and trustworthy in practice. It has at present been mainly used for testing electric culverts and street boxes for coal gas, but it is evidently applicable to testing for coal gas or for other inflammable gas or vapor in the air under any conditions.

For the perfecting of the details of all these forms of testing apparatus, acknowledgment is due to Messrs. W. J. Fraser & Co., of 98 Commercial street East, London, who are the sole makers and licensees of the apparatus in this country. Further details of the forms of testing apparatus are obtainable from Messrs. Fraser, or from their agents, the Gas Lighting Improvement Company, 18 Devonshire street, E.C.

A full and detailed description of these different forms of testing apparatus, with illustrations, will shortly appear in the lecturer's book on "The Detection and Measurement of Inflammable Gas and Vapor in the Air," which is nearly ready for issue by Messrs. Crosby Lockwood & Son, who have courteously allowed the use of the block of the scale showing standard hydrogen flames and caps, with the percentages of coal gas indicated.

Discussion.

The President said they had all listened with great interest to the lecture, and he had no doubt the gas industry would derive considerable advantage from the use of the ingenious apparatus that Professor Clowes had devised.

Mr. J. Stelfox (Belfast) proposed a hearty vote of thanks to Professor Clowes for the very able and lucid manner in which he had brought before the meeting a most interesting and important subject. Even if his position admitted of his introducing any debatable matter, motives of principle would make him hesitate to do so; but he might say they did not believe them to be guilty of quite so much iniquity in having carbureted water gas as appeared by the proportion of carbonic oxide shown in the table. That, however, was a matter which would vary with the amount of oil used. So much had been said as to the danger of water gas, that they looked very seriously on anything in the nature of what they called "gassing." Formerly, if a man inhaled coal gas, they used to give him a bottle of porter or soda water, and lay him on his back. Sometimes he was sick, but they never apprehended any danger. More recently, as an additional precaution, they had provided an oxygen bottle, but it had only been used once. They had had three cases where men had inhaled water gas, in two of which it arose entirely from want of due caution, and one only was serious and had to be treated medically. In one case, a man working on the top of a scrubber got himself twice "gassed," but he went in the third time, after he had revived somewhat on the outer balustrade. He was able to walk down the spiral steps 65 feet to the ground, and then succumbed. The second case was that of a fitter who went to drill a hole in a pipe through which carbureted water gas was passing, and allowed the issuing gas to strike full in his face. He also took a good dose. But there was nothing serious; and, after walking him about a little while, he recovered. The third case, which happened quite recently, was the only one in which no blame attached to the man. A slight leak developed in a purifier, where this man was working for some hours. He made no complaint, except of a little headache, all the morning; but about an hour and a quarter after dinner, he began to feel giddy and faint. He had, perhaps, a little physical weakness, which laid him open to the influence of the gas. It was now suggested that, in addition to an oxygen bottle, a small colony of mice should be kept on hand. But it occurred to him that something might depend on constitution, and he should hardly like to depend too much on the mouse. Possibly, if it were a delicate man and an able-bodied mouse, the former might suffer more than the latter. He was sure they would all agree in according to Professor Clowes a cordial vote of thanks.

Mr. C. Stafford Ellery (Bath) seconded the motion, and desired to thank Professor Clowes especially for the very complete way in which he had illustrated his lecture by experiments. He hoped that, useful as the apparatus he had shown might be, none of them would have frequent occasion to use it.

The motion having been carried unanimously,

Professor Clowes, in reply, said a large portion of the thanks was due to Mr. Davenport, who had so ably assisted him in the experiments. He thought Mr. Stelfox had slightly mistaken what he had said about water gas. The analysis he had shown was that of American carbureted water gas, not coal gas enriched with water gas.

Mr. Stelfox said they made water gas from coke, with from 28 to 32 per cent. of carbonic oxide.

Professor Clowes said the figures he had given were American, and were, he believed, generally accepted. Of course, if the water gas were at all impure, the proportion both of hydrogen and carbonic oxide, would fall in proportion. He did not think there was any danger to be apprehended from a mouse having a healthier constitution than a man; but there was another point upon which he at first had some qualms, and that was the Anti Vivisection Act, under which any experiments on live animals were forbidden except to persons holding a license. It was pointed out, however, by Dr. Haldane, that the mouse suffered no pain during the proceedings, and therefore the Act did not apply.

Letting Gas Apparatus on Hire.

[A paper read by Mr. N. H. Humphrys, of Salisbury, before the 33d Annual General Meeting of the Incorporated Gas Institute.]

The adoption of the plan, in one form or another, of assisting the consumption of gas by letting out appliances on hire is now becoming so common among gas companies that a few considerations suggested by some years' experience may not be out of place. It became the usual thing, so far as gas meters are concerned, at a very early stage in the history of our industry. Consumers objected to pay down a cash price of some pounds for an article that was of no direct or evident service to them; and, on the other hand, the vendors of gas discovered the desirability of keeping the control of the meter in their own hands. But with one or two notable exceptions the hiring business stopped at this point for many years; and it is only within comparatively recent times that it has been extended to take in gas stoves, and sometimes other appliances. It is to this class of business that the following remarks are intended to apply; the meter business being a special branch that requires to be dealt with in a special way, as, for obvious reasons, the meter cannot be classed with gas consuming apparatus, though some of our customers might think it would be rightly placed.

The hiring department is not entered upon as a direct source of profit, like the utilization of residuals or the crushing of coke. I question whether in any case a fair balancing up of income and expenditure over a period of several years' working would show a result on the right side. Nor would it be wise to look to the hiring department for a substantial contribution towards the balance available for profit. The chief object in view is something beyond placing out as much apparatus as people will take. It is the securing of a particularly profitable line of business—such as summer or day consumption—which enables an increased annual output to be met without a proportionate addition to the capital account. Practical experience has shown that this is only one of many advantages that are secured; and hence the popularity of the hiring system. The manager of the gas works is brought into closer touch with his customers, and enabled to acquaint himself with their views and requirements in a way that would not otherwise be practicable. If judiciously worked its introduction will be accepted as an act of grace on the part of the gas company, and as evidence of a desire to meet the needs of the customers, even if some trouble and expense is necessary to do so. It encourages a good feeling all round, and shows that the sellers of gas have a soul that rises to higher things than the mere pocketing of as much of the customer's cash as the Act of Parliament will allow them to take. The better feeling that now exists towards gas companies, as compared with the popular opinions of 15 or 20 years ago, may be partly credited to the introduction of the hiring system. So this plan may be regarded as an advertising line that no undertaking desirous of keeping abreast with the times, and making the best of its resources, can afford to ignore.

Another benefit that has followed the introduction of the hiring system is the active enterprise that it has been the means of promoting

amongst manufacturers of gas appliances, which has told in favor of the consumer as well as of the seller of gas. The possibility of obtaining large orders from gas companies has furnished an inducement that is not supplied by the ordinary wholesale and retail trade; and the makers have received every encouragement to turn out a well made, strong and efficient article. The gas companies, knowing the responsibili y they are undertaking, are keener and more judicious purchasers than the average householder. Handsome outlines, elegant ornamentation and other attractions of a shallow nature that are good enough to draw an ordinary purchaser, have had to give way to something of a more substantial character. An American gas engineer lately complained that the public did not value efficiency, and would not give even a shilling more for a better made article that would be more durable and use proportionately less gas. But makers have appreciated the fact that the goods required for hire must be strongly made, simple and easily kept in order, and not wasteful or extravagant in the matter of gas consumption. The result is that no one need hang back from the hiring business on the ground that suitable apparatus cannot be obtained, for there are several well known makers whose goods can be relied upon to give satisfaction, and to last, under reasonable working, long enough to pay for themselves.

As in the case of advertising, it is possible to be so niggardly in the matter of hiring that the anticipated benefits, if realized at all, are only partly gained, and, on the other hand, to be so prodigal that the outlay is two or three times as much as is necessary. In most districts its introduction will be well received and promptly accorded a generous patronage. This apparent success may be the means of laying a foundation for future trouble; and in forcing the capabilities of the available staff, in order to meet all demands promptly, mistakes may be committed that are not so easily rectified. Everybody concerned must keep prominently before them the fact that something more than the mere establishment of a large hiring trade is in view, and that the free and easy distribution of apparatus to all who apply for it is a very costly way of securing the desired results. An insurance company that accepted every proposal received, without inquiry, would soon experience heavy loss; and while a proposal to hire a stove is scarcely such a serious matter as an insurance policy, still it is worth while to take some trouble in considering each application on its own merits. In fact, I question whether it would not be a good plan to keep a regular form for signature, in which a reasonably steady and regular use of the appliance is made one of the conditions of hiring. For two things soon become evident—first, that many customers do not object to hire an appliance at a small rent simply to be kept in readiness for emergencies; and, secondly, that the hiring system is popular among those long-winded customers who suffer from a chronic tendency towards the arrears list. Therefore, it is well to have a distinct understanding from the first that there is no obligation to let on hire, and that a customer has no legal right to call at the gas works and demand apparatus on hire on the same terms as he can call for a supply of gas; but rather that each application will be fairly considered on its own merits, and accepted or declined as may appear desirable. In any case, it is well to make a rule that apparatus should not be hired to parties who are habitually behindhand in their payments.

It is especially at exhibitions that the necessity for these precautions arises. The salesmen are rightly anxious to place as many goods as possible; and some difficulty will arise if they are allowed a free hand in the matter of pledging the gas company's credit by the indiscriminate acceptance of all and every application for hire. Let them sell freely, by all means, on cash terms; and let them receive as many proposals for hire as they can get. But it must be understood that the gas company's officers will subsequently investigate each case. If the salesman does happen once in a way to waste half an hour's eloquence on a countryman who has casually dropped in because he is on a visit to town and wants to see everything, but who has never resided within ten miles of a gas works in his life, the company suffer no harm. But the case is different if a simple-minded person is persuaded to take an unsuitable or excessively large appliance that will use more gas than he can conveniently pay for; or if a valuable article is intrusted to a party of shady credentials, or who is frequently traveling or away from home. If the company are in the happy position of being able to afford to be liberal, surely it is worth while to take care that their favors are bestowed where they will be appreciated, rather than to follow a "rough and tumble" system of serving all alike. They must keep a free hand. Sometimes it is necessary to decline hiring altogether; and in other cases special concessions can be made with advantage.

It is well to recognize at the outset that the investment in apparatus for hire is subject to special risks. Ample allowance must be made for wear and tear, as people do not look after hired goods as they do after their own property, though cases of wilful or reckless injury are quite exceptional. The chief danger to be guarded against is the accumulation of useless and idle stock, or of goods that are out of favor as being old fashioned. The consumers strongly appreciate the fact that hired apparatus can be sent back at any time. The numerous improvements that have followed each other during recent years have increased the difficulties in this respect. With the new enameled cooking stoves on view, it is a bad job for anyone who has a large stock of second-hand sheet iron cookers on hand. Deceases and changes of residence result in stoves being returned, so the possibility of accumulating stock is an ever present danger. It is not safe to supply anything of a special character on hire; but only such appliances as are in general demand in the district. The variety of apparatus, and the number of sizes of each variety kept for hire, should be carefully limited according to the magnitude and class of business done. A very small undertaking should not hire out more than a few medium sized stoves, and for districts of anything under 1,000 consumers it is a good rule to keep to one make of stove or gas fire, and to have special terms for either very large or very small sizes. In our large towns, where stoves are let out by the thousand, these considerations do not apply; and other questions come in.

In any case the hiring department should be under competent supervision; and when the number of appliances let out begins to be counted by the hundred, it requires more care than the manager of the gas works, with his numerous other responsibilities, is able to bestow. It is not sufficient to serve out the apparatus and leave the customer to do what he likes with it, trusting him to complain if anything is wrong; but the apparatus should be inspected at periodical intervals varying from a month to two years, according to circumstances. In practice, the gas company are responsible for the fixing and proper action of the apparatus, as well as for maintaining the same in an effective state. Gas fires or gas cooking stoves do not cause much trouble; but with some classes of apparatus—such as high power lamps—regular attention is required. The hiring department, therefore, means an important addition to the responsibilities, and calls for additional storerooms, workshops, and a staff capable of executing ordinary repairs, in addition to being able to fix the apparatus promptly and efficiently, and to advise consumers generally.

I prefer to include the cost of fixing as a part of the investment, and in ordinary instances relieve the customer of all trouble and expense as regards fixing. But in particular cases, where a long length of pipe is required, or where gas is not already laid on, and will not be used for anything else, a special charge is made. For hiring purposes the cost of the stove must, therefore, be regarded as including the necessary pipe, fitttings, and labor for fixing them; and the cost, of course, governs the charge for hire. If a customer wishes an appliance put in a place where it will be ineffective or a cause of nuisance, it is better to refuse to fix it, at the risk of losing his order. Every piece of apparatus that is acting efficiently is an advertisement in itself; and the same applies also to every defect or failure. Appliances for hire can scarcely be ranked as permanent capital, though there is no objection to a reasonable proportion of their cost being charged to capital. They may be classed in the same position as tools or retorts, which are replaced at the cost of the revenue when obsolete or worn out; but I prefer to regard them as floating capital, by keeping them in the stock account. On one side we have the first cost of new appliances, including fittings and accessories, if provided, and the cost of renewals, maintenance, etc., and, on the other, the receipts for rents. Receipts for stoves sold, or special charges for fitting, are deducted from the cost of new appliances. The results of a year's working then come out in the form shown, as follows. (See next page.)

In any case it is desirable to make a separate account of the expenditure on the hiring department, both for additions and for current expenses, so that at any time its position can be reviewed, and the hiring charges rearranged if necessary.

Taking the actual expenditure on goods for hire, inclusive of labor and material for fixing, a reasonable rental for a gas company to charge is 10 to 12 per cent. for cooking stoves, 15 to 20 per cent. for heating stoves, and 20 per cent. for high power lamps. Heating stoves should be charged at a higher rate than cooking stoves, because they are only used intermittently, during the winter months, and therefore do not represent a specially remunerative class of business; and high power lamps need more frequent attention in the way of maintenance than stoves.

At these rates, the hiring department will be about self-supporting, without allowing interest on the capital invested. But special circum

.....Gas Company.

Hiring Department.

To new appliances, pipes, fittings, etc., for hire—			By rents received during year.....	$625
Balance from last year.....	....	$5,000	Balance to next year...	5,125
Expended on same this year	$750			
Less appliances, etc, sold....	250			
		500		
Repairs, maintenance, etc., materials and labor, including new appliances in place of old	....	250		
		$5,750		$5,750

stances may arise—as when the manufacturing and distributing plant is in excess as compared with the actual business done—which render it advisable to make some reduction on the above rates, in order to push business in particular lines. On this point, however, no general principles can be laid down. I do not believe in short-period hiring, except at special and directly remunerative rates; but I make it clear that the object is to obtain, not temporary sales, but a solid and permanent business. So no appliance is let for less than 12 months at ordinary rates, though special arrangements may be entered into for short periods. There is occasionally a disposition to "try on" for cooking stoves in the summer only, and for heating stoves in the winter; but anything of this sort is decidedly opposed. The amount due for rent is made up to each quarter day, and charged with the gas.

At Salisbury there is now the following apparatus out on hire: 262 cooking stoves, 7 boilers, 26 gas fires, 170 high power lamps—total, 465. The cost of these, including fixing and every expense, was $13,500; and the annual cost for repairs and renewals $500 to $600. The receipts for rents are $1,175 per annum. Of the expenditure, $5,000 has been placed to permanent capital, and the balance stands in the stock account, and at present amounts to $2,000 or so. Nearly half the total cost has therefore been paid off, and the greater part of this repayment has come from the rents received. Therefore, after paying all maintenance expenses, a balance of over $500, or, say, 7 per cent. on our actual capital concerned, remains. I propose to apply this to the extinction of the stock account, and after this is done shall consider that it may legitimately be appropriated as profit. Though we have a large investment for our district of 1,600 customers, it is now self-supporting, while the additional summer and other consumption is a useful help towards the prosperity and security of the business. I should like, in conclusion, to mention that the hiring system was introduced in Salisbury by the late Mr. Thomas Hardick nearly 30 years ago.

The Popularization of Gas.

[A paper read by MR. A. DOUGALL, of Tunbridge Wells, before the 33d Annual General Meeting of the Incorporated Gas Institute.]

The subject which I am to bring before the Institute cannot lay claim to scientific interest, or novelty of any kind; but I trust it may give rise to a discussion which will be both interesting and profitable to the members generally. The popularization of gas is a comprehensive subject, but it is my intention to confine my remarks to that part of it relating to the coin meter system, which has not yet been brought before this Institute in the form of a paper. By this system we are introduced to a new class of consumers who were, by the force of circumstances, unable to avail themselves of the advantages of gas under the old dispensation. The restrictions placed upon the supply of gas by requiring deposits, payment for services, meters and fittings, together with the prospect of a quarterly account, formed obstacles not to be overcome by the artisan and working class population. The invention of the coin meter at a time when gas was brought into keen competition with cheap oil on the one hand and electricity on the other, was hailed as the solution of a problem which had long exercised the attention of gas engineers. The readiness on the part of gas companies and gas committees to adopt the new meter stimulated inventive genius, and there are now many coin meters of a reliable nature.

When it was first proposed to introduce the new system into Tunbridge Wells, it was thought that there was little scope for it in a residential town, and that it was more likely to suceeed in industrial places with thickly populated districts. On examination, however, it was found that the houses where gas was used were fewer in number than those where other illuminants were employed. In the year 1891, out of 5,300 inhabited houses, 2,925 were without gas. With these facts before them, the Tunbridge Wells Gas Company decided to give the system a trial, and agreed to fit up, free of cost, houses where the annual rental does not exceed $100 and the distance from the mains is not beyond 50 feet. Under this arrangement, the Company lay the necessary service pipe, fix a coin meter, and run supplies to four different places; providing one telescope pendant, two brackets and a small boiling ring or cooking stove.

The work of fitting up the houses was let to a thoroughly reliable contractor, with whom the following agreement was made:

Arrangement for Fitting up Small Houses, the Rental of which does not Exceed $100 *per Annum, under the Coin Meter System.*

The Company will lay service, fix meter and supply pendants, brackets, boiling stoves, tube backs, wood blocks, nose pieces, burners, flexible tube, composition pipe, hooks and other fittings required.

The contractor will provide all tools, nails, screws, solder and other materials necessary for connecting up outlet of meter and running supply to four separate places in each house. He will also cut away, and afterwards make good, all needful plaster, woodwork, brickwork, paint and paper, and complete the work to the satisfaction of the Gas Company's inspector. He shall be paid the sum of $2 for each house so fitted up, or such a sum as may be agreed upon when the full amount of work, as above stated, is not carried out.

He shall also be paid 50 cents as commission for each new consumer obtained by him, for which he shall obtain the signature of the landlord to the printed "form of consent" provided by the Company, inquire into the respectability of the applicant, and report all orders and information to the Gas Company's offices.

The local directory was brought into requisition, and all houses not already supplied with gas were marked. A handbill announcing the new departure was left at each of these houses, and a few days afterwards the contractor called and explained more fully the working of the system. After this the applications came in so quickly that it was difficult to execute the orders as promptly as the clients wished. The demand for coin meters all over the country taxed to the utmost the resources of the manufacturers; and, even if desired, it would have been impossible to obtain from any one maker a regular supply in anything like reasonable time. A plan, however, was adopted of dividing the town into districts—a different make of meter being used in each; and in this way the difficulty of obtaining the requisite number was overcome. In the event of any complaint being made, this plan has the further advantage of enabling the inspector to tell, without reference to his book, the maker of the meter in fault.

In very few instances has the introduction of this system necessitated the laying of new mains. As a rule, a pipe supplying public lamps and occasional consumers in the ordinary way, and large enough for the fresh demand, was already there; so that in our case the expenditure under this head was small. New services, however, have been required; and to supply the 1,600 consumers under the new system, over 8 miles of wrought iron tubing have been laid, or about 28 feet per consumer. Remembering how quickly this tubing oxidizes in some earths, the cost of renewing must be taken into account, for although it may be said that the length of the service to these consumers is not greater than that to ordinary ones, yet it must be remembered that the quantity of gas used by them is only small, and that the proportionate cost to the Company is therefore much more. Defective services have much to answer for in increasing the leakage account; and where this system is extensively adopted there must be more loss from this source in the future. In Tunbridge Wells the average consumption is 60,863 cubic feet per ordinary consumer, and 9,918 cubic feet per consumer under the new system. Reckoning the length of service pipe in both cases to be the same, the loss by leakage would be increased from the source indicated.

The fixing of the meter in a place convenient to the gas company, and at the same time acceptable to the fastidious tastes of our new consumers, is not always an easy matter. In the majority of cases the front room is selec ed, as being the most convenient place to run the service to; but where part of the house is sub-let, and the meter is under the control of one of the occupants only, difficulties arise. The lodger may go out and lock up the room containing the meter, and thus prevent the tenant putting in his coin in the event of that operation being necessary. Though it may be easier, in the first instance,

to put the meter in the front room, it is advisable, for the satisfactory working afterwards, to fix it in a place where it can be readily got at by all concerned.

From the meter, composition pipe was at first used entirely for piping the houses; but its liability to sag, and the risk of leakage by nails being driven into the pipe, led to the use of a combination of iron and composition, iron being used under the floors and composition on the walls. The fittings supplied to such consumers should be strong and good; the annoyance and expense occasioned by cheap fittings should be guarded against. When a company undertakes the oversight of such a large number of the consumers' internal fittings the importance of securing, in the first instance, strong and well-made ones must be apparent to all. Money laid out in this direction is well spent. To many gas companies this new departure will entail an extra staff of men to attend to the appliances on hire. A periodical inspection of these must be made to insure satisfaction, and fittings must often be brought to the workshop to be overhauled and put in order. Burners, which have so much to answer for in the wasting of gas, must be renewed from time to time, and some cheap form of governor burner should be supplied.

As far as lighting is concerned these consumers would not be worth securing, their requirements in this direction being so limited. The convenience of gas as a heating and cooking agent is, however, highly appreciated by the working classes, and it is because of this that the new departure can be made remunerative. The readiness and facility with which a supply of hot water can be obtained by means of the boiling ring make it a great boon to such people, and I believe it was mainly on account of this that the coin-meter system found favor in its early days, and has since grown to be so popular with the class for whose benefit it was conceived. We do not, however, stop at the boiling ring, but lend, free of charge, cooking stoves, tailors' irons, etc., to those consuming under this system, looking to the increased consumption of gas for a return on the additional outlay. Of the 1,600 consumers with coin meters 882 have cooking stoves, and I believe in the near future a much greater number will be supplied with these stoves. It encourages a day consumption which we are all anxious to cultivate.

Gas compares very favorably with coal bought in small quantities, especially when it is directly under the control of those paying for it, and not subject to the wastefulness of servants. Much ignorance prevails with regard to the use of gas cooking stoves, and the gas exhibitions which are now so common in our towns do not reach a large section of those who specially need instruction. They will not attend demonstrations of cookery, which are often beyond them, and we have, therefore, decided to give homely lessons in cookery by gas in various parts of our district. These will be given, not by a professional cook, but by the wife of a working man, who is well up in the subject and possesses a natural aptitude for imparting to others what she herself knows. It is intended to engage a room, and invite those in the neighborhood to attend these lessons in a homely way. By such means practical knowledge will be spread amongst a class who, by reason of the exigencies of their position, cannot otherwise obtain it.

I believe that the time has arrived when purveyors of gas should undertake gas fitting in all its branches. Ironmongers nowadays, anxious to keep abreast of the times, are too ready to recommend their customers to have their houses wired for the electric light, rather than piped for gas, and it behooves us to look after our own interests in this matter. Where there is a staff competent to deal with the fittings of prepayment consumers the work of fitting up other houses under the ordinary system could be managed without much addition to that department.

There is in Tunbridge Wells a considerable number of houses of a rental of from $100 to $175 a year that are not fitted for gas; and it has been decided to extend the benefit of the system to these, substituting, if desired, a 25-cent coin meter. The expense of fitting these larger houses is greater, but the consumption is sure to be more, and in that way the additional expenditure will be justified. I am unable to give at present any reliable figures with regard to these larger houses, but I feel sure the application of the system to such is a step in the right direction.

When the popularity of the coin-meter system is thoroughly established in a town it is well to announce to architects and builders that the gas company are prepared to lay the pipes for gas to be supplied under the coin-meter system in cottages during erection. Some landlords object to have their property pulled about by the laying of the necessary pipes, and, in the case of new cottages, it certainly is mutually advantageous to have the pipes put in before they are finished. Gas is so popular with the working classes that there is little fear of the tenant not requiring it.

It is advisable to make monthly collections by intelligent collectors, competent to give advice in simple cases. The company will thus be in frequent touch with the consumers, their requirements can be promptly attended to and more general satisfaction given. One of the difficulties inseparable from the coin meter is the discrepancy that is often found between the registration of the meter and the money found in the box. I do not refer to flagrant cases, where it is apparent that something is wrong, but to the small amounts of "shorts" and "overs." When a few coppers are short it is impossible to convince the consumer that such is the case, and still more impossible is it to get him to pay the deficiency. The loss of confidence caused by pressing for payment is not to be compensated for by the recovery of these small sums, which only amount to about 1 per cent. on the prepayment rental, or, say, one cent per thousand cubic feet. It is better to write off these deficiencies each year, and regard them as expenses incidental to the system. To provide against loss in this way it is a good plan to set the meter rather under the quantity allowed for two cents, and when there is anything over to return it at the end of each quarter. There is obviously no difficulty in dealing with an excess; but it is not so easy to recover a few cents that may be short. Various means of collecting the coppers are adopted, according to the amount to be dealt with. Our collectors have a strong lad with a bag, and in this way they manage very well. Tricycles and carts are used for such purposes, and no doubt, where the amounts are large, some such arrangement is necessary. It is rather a troublesome matter to dispose of these coppers. Some companies get their bankers to accept them for a consideration, but we find the tradesmen are glad to have them.

The cost of fitting these houses, including service and meter, has been $19.06, and when a cooker was supplied, $29.06, making an average of $24.06, while the cost of connecting an ordinary 3-light consumer is about $10. From this source, therefore, there is an extra capital expenditure of $14.06, but inasmuch as this new business is obtained without an additional expenditure for mains I think we might set the saving effected in this way against the extra expenditure indicated. If that be so then there is no interest on extra capital employed to take into account. It will only be necessary to allow for wear and tear of meter and fittings, extra cost of collection and attention to meters, etc., to put these consumers on the same basis as ordinary ones.

Now, judging from the reports which have appeared from time to time in the *Journal of Gas Lighting*, the consumption of gas by these consumers varies very much in different towns. The extra price charged to cover the expense of fittings is also a variable amount, and one which must be regulated principally by the average quantity used per consumer. The question naturally arises, "What is a fair price?" Take the case of Tunbridge Wells, where the cost and consumption are as follows:

	Cost, Including Meter Pipes, Fittings, Boiler Ring, Service and Labor.	Average Consumption. Cubic Feet.
Without cooker	$19 06	6,189
With cooker	29 06	13,648
Average	$24 06	9,918

The price to the ordinary consumer is 75 cents per 1,000 cubic feet, and we give these consumers 21 cubic feet for 2 cents, which is about 23 cents more per 1,000 cubic feet. Now, 9,918 at 23 cents = $2.37, which may be hypothetically distributed as follows:

Wear and tear	$1 87
Extra collection and attention to meters, etc.	50
	$2 37

This I consider is a fair amount to cover the extra expenditure.

These prepayment consumers are specially satisfactory from a gas manager's point of view, as they take their supply uniformly throughout the year. This will be seen from the following figures:

1895. Quarter Ending.	Ordinary Consumption. Cubic Feet.	Prepayment Consumption. (1,090 Consumers.) Cubic Feet.
March	59,477,300	2,261,600
June	27,541,000	2,111,000
September	27,921,100	3,451,000
December	53,349,000	2,993,000

Taking this new business as a whole, it is remunerative from the first, and that is more than can be said of every new undertaking. The quantity of gas used varies very much, as will be seen from the

following table, which gives separately the consumption by those who have cookers and those who have not:

With Cookers.		*Without Cookers.*	
No. of Houses.	Cu. Ft.	No. of Houses.	Cu. Ft.
2 with consumption under	3,000	9 with consumption under	1,000
4 " " "	4,000	30 " " "	2,000
5 " " "	5,000	30 " " "	3,000
7 " " "	6,000	48 " " "	4,000
9 " " "	7,000	51 " " "	5,000
8 " " "	8,000	59 " " "	6,000
18 " " "	9,000	54 " " "	7,000
14 " " "	10,000	50 " " "	8,000
15 " " "	11,000	42 " " "	9,000
14 " " "	12,000	41 " " "	10,000
12 " " "	13,000	37 " " "	11,000
22 " " "	14,000	23 " " "	12,000
13 " " "	15,000	14 " " "	13,000
15 " " "	16,000	15 " " "	14,000
9 " " "	17,000	8 " " "	15,000
6 " " "	18,000	10 " " "	16,000
8 " " "	19,000	6 " " "	17,000
7 " " "	20,000	4 " " "	18,000
5 " " "	21,000	2 " " "	19,000
3 " " "	22,000	4 " " "	20,000
4 " " "	23,000	2 " " "	22,000
7 " " "	24,000	1 " " "	24,000
4 " " "	25,000	1 " " "	25,000
3 " " "	26,000		
2 " " "	27,000		
2 " " "	28,000		
1 " " "	29,000		
1 " " "	31,000		
1 " " "	32,000		
1 " " "	33,000		
1 " " "	35,000		
1 " " "	43,000		
1 " " "	64,000		
225		541	

These consumers have been burning gas during the whole year.

It is evident, from the above figures, that many of those who have cookers are not making much use of them. I am disposed to put this down, in most cases, to ignorance as to the proper management of the stoves, and would recommend district lessons in cookery to be given in the way I have already indicated, taking special care to secure the attendance of those who are most in need of such instruction. When stoves are lent free of charge, there are many ready to apply for them; but, with the first difficulty, they lose heart, and will not persevere, but simply go back to their old way of working. It will pay to take some trouble at first to instruct such people, for if once they get into the way of properly managing the stove, they will never return to the coal fire. Gas companies and corporations must, however, in many cases, do more than simply fit up a cooking stove free of charge. An artizan will sometimes pay as much as 14 cents or 16 cents a week for wood for his kitchen range, and surely if he can save that, and the trouble of lighting a fire as well, he will, in the summer months at all events, find the gas cooker a great boon.

Until lately we have had one agreement for the landlord and another for the tenant; but now we have adopted a combined agreement which is more simple, and which provides for a change of tenant without requiring a new form. A similar form is used by several companies.

APPENDIX.—*Agreement for Supply of Gas and Hire of Fittings under the Prepayment System.*

To the Tunbridge Wells Gas Company:

I,.....of.....
being the owner of the dwelling house known as No.....
and situate in.....Tunbridge Wells, of which.....
is the tenant, do hereby authorize the servants of the Tunbridge Wells Gas Company, with the consent of the tenant, to enter and fix therein the automatic prepayment gas meter, pipes, stoves and other fittings mentioned in the schedule hereto, and likewise at any time thereafter to enter to add to, repair, renew, or remove the same, the Company bearing the sole cost thereof, and making good any damage done to the premises in the course of fixing or removal; and I hereby acknowledge that the said gas meter, pipes, stoves and fittings are the property of the said Gas Company, and that the same shall not at any time during my ownership of the house be liable to distraint for any rent due from the present or any future tenant of the said dwelling house.

Dated this.....day of .. ..189....

Signed..... .....

And I, the said.....
the tenant, hereby agree as follows:

1. That I will consume the gas of the above Company and pay for the same and for the hire and maintenance of the said gas meter, pipes, stoves and fittings at the current rate charged by the Company, by depositing money in the automatic prepayment meter provided by the Company.
2. That I will give the Company immediate notice of any defect in the said gas meter, pipes, stoves or fittings; and I undertake that the said gas meter, pipes, stoves and fittings shall not be sold, removed, or damaged (fair wear and tear excepted) during my occupation of the said dwelling house.
3. That in case of any defect in the automatic arrangement of the meter permitting more gas to pass than is accounted for by the number of pennies found in the box, I hereby agree, on demand being made, to pay for such additional quantity of gas as may be registered on the index of the meter.
4. That the servants of the Company may enter at all reasonable times to collect the money, or to inspect, repair or renew the said gas meter, pipes, stoves or fittings.
5. That should I wish to cease consuming the gas of the said Company at the above premises, I hereby agree to give the Company seven days' notice in writing of my intention so to do.
6. That should the Company desire to cease the supply of gas to me, or to remove any gas meter, pipes, stoves or fittings, for any other reason than that of improper use or fraud, they shall be at liberty to do so on giving me seven days' notice, in writing, of such their intention so to do; and the servants of the Company shall at any time thereafter, during my occupation of the said premises, be at liberty to enter to inspect, repair, renew, or remove the said gas meter, pipes, stoves or fittings.

Dated this..... ...day of.....189....

Signed.....
Tenant of.....

Schedule.

Automatic prepayment gas meter No.....
Main cock and connections.
Pendant.
Brackets.
Burners.
Cooking stove.
Boiling stove.
Feet of connecting tube.
Feet of compo. pipe with blocks and all connections.

Some Central Station Economies.

At the convention of the Canadian Electrical Association Mr. R. G. Gossler, in the course of a paper on the above-named subject pointed out the necessity of having reliable records setting forth the details of the operation. These are of special value in cases of reconstruction, The paper is based upon the reconstruction of a particular plant. In connection with a pole catalogue, giving the number and location of each pole, circuit maps were arranged, which consisted of diagrams for each circuit, showing the streets upon which the circuit ran, and the size and length of each section of wire or wires.

At the same time these records were being made out transformer charts were prepared, which consisted of maps for different sections of the city covered by the different circuits. On these maps each transformer was located by a small square stamped on the map, and within this square was written the name of the customer being served from this transformer, the number of lamps installed, the revenue per year, the revenue per lamp per year, the estimated number of hours burned per lamp per year, and the probable number of lamps burning at any one time. There is also indicated on these charts the size and length of secondary wires from the transformer to the customer's cut-out. All this information was found necessary for the proper "bunching" of customers on the transformers and for the loading of the transformer.

Wherever possible secondary systems were established, to which several transformers were connected in parallel, in which case the size of the secondary mains between the transformers was such that the drop in these mains was small compared to the drop in the trans-

formers themselves. In this way the transformers were made to share, more or less, the load equally between them. When a secondary system of distribution was not economical, single transformers were located. In determining whether a customer was to be included in a bunch of customers, all of whom were to be fed from one transformer, or whether it was more economical to place a separate transformer, it was necessary to make an approximate estimate of the cost of locating the transformer for each case. When the interest on the cost of placing a separate transformer plus the cost of maintenance of the transformer was more than the interest on the cost of connecting a customer to a transformer feeding other customers, the connection in question was made to the transformer feeding the "bunch."

The author stated that a guaranteed transformer leakage should be obtained from the manufacturers; substitute these guaranteed leakages for the different sizes of transformers in a table and a comparative statement of the annual cost of different makes of transformers can readily be made from which the most economical type for the local conditions can be determined.

In connection with the above transformer construction, regulation and efficiency should be considered.

There is but one course to follow if the station be loaded with unnecessary transformer leakage, and that is to replace, at the earliest possible moment, the old transformers by new transformers, using secondary systems where economical, and by this replacement cut down operating expenses and increase the station capacity.

Lamps with long life are found to be inefficient; very efficient lamps are usually short lived. There is a point between these extremes which makes a lamp suitable for electric lighting station use. Using an efficient lamp increases the earning capacity of a plant and permits of using higher candle-power lamps with a proportionally less increase in cost. An increase in candle-power either by high candle-power incandescent lamps of high efficiency or small incandescent arc lamps, seems to be the best way to meet competition from gas, either with the ordinary or the "Auer" burner.

It has been advocated by some, to meet this demand for more light, to run the lamps at a voltage above that for which they are rated, thereby running the lamps at a high efficiency.

Conditions.—To determine what lamp is best suited for any electric lighting station it is necessary to know the cost of producing current per lamp-hour, and having established this for any special make of lamp the following formula will permit of a comparison of different makes of lamp and the determination of the best lamp for the conditions under which they are to run. In considering the cost of production per lamp-hour in connection with the lamp question the cost of service may be divided into three parts:

A. That portion of the service per lamp hour that is practically not affected by the average efficiency and life of the lamps and such portion of the maintenance, operating and general expenses, as is practically not increased by increasing the current consumption per lamp-hour.

B. The cost per lamp-hour, coal, water, interest and depreciation on the lines, dynamos, engines, etc., and such part of the expense of the service as increases proportionately to the amount of current served per lamp-hour and as the maximum station output.

C. The cost of the lamp per lamp-hour, and the expenses per lamp-hour for replacing exhausted lamps. This is equal to the cost of one lamp, plus the cost of exchanging one exhausted lamp, divided by the average life of the lamp.

Under the first division (*A*) should be included the cost of fuses, meters, transformers erected and secondary connections, line construction, maintenance, etc., and such proportion of the operating and general expenses as is not increased by increasing the current consumption per lamp-hour.

Under (*B*) should be included that portion of the cost of service per lamp-hour exclusive of lamp renewals that increases proportionately to the current consumed per lamp-hour.

These divisions of cost should be so made that the sum of *A*, *B* and *C* will represent the total cost of service per lamp-hour, the values of *A*, *B* and *C* representing the above divisions of cost having once been established for a lamp of any given efficiency and average life for any particular lighting station the cost of service per lamp-hour for this same station with any other lamp which has a current consumption different from the current consumption of the first lamp, and having an average life of "*Y*" hours, would be $A + XB + C =$ the cost of service per lamp-hour, "*X*" representing the proportion between the current consumption of the lamps being compared, and "*C*" being the cost of one of the new lamps, plus the cost of replacing one exhausted lamp, divided by "*Y*," the average hours of life of the new lamp.

This formula applies for comparing the cost of producing light with lamps having different costs, efficiency and average lamp-life, when they are to be burned in the same plant and under the same conditions of average lamp-hours burned per lamp installed, and the same maximum number of lamps burning for a given number of lamps wired. Value (*B*) in this formula includes the coal consumption and the materials, which practically vary proportionately to the watt-hours output required for providing the light. It also includes the interest and depreciation on the plant, which must be enlarged when the lamps consume large amounts of current, because the generating and supplying capacity of the plant must be proportionate to the maximum output called for by the lamps. In many plants the interest and depreciation account will form quite a considerable portion of the factor *B*, and as a large value to the factor *B* makes a showing against the high consumption of current per candle-power hour very bad, it would appear that any lamps installed that did not burn at the time of maximum current output from the station could be economically used of a poorer efficiency with longer life than lamps which do burn at time of maximum output, because any additional demand for current on a plant that is not a call for current at the time of maximum output does not require an increase of plant capacity. In estimating the best efficiency per candle-power hour, or per lamp-hour, for these lamps that do not burn at the time of maximum output, the cost of interest and depreciation entering into the factor *B* in the formula (in fact all the costs that increase proportionately as the size of the plant required to serve the lights wired) should be excluded from the factor *B*. The result is that lamps that do not burn at the time of maximum output can be economically used of considerably lower efficiency than lamps that do burn at that time.

Specifications for Structural Iron and Steel.

[By Mr. B. L. Worden, in the *Wisconsin Engineer.*]

The preparation of specifications for structural iron and steel presents peculiar difficulties to an average man engaged in the general engineering practice, and the almost universal employment of these materials in work of all descriptions makes it an important part of the duties of every engineer. This, together with the fact that comparatively few outside of those connected with manufacturers of structural steel and iron approach the subject with a thorough comprehension of what is required, is what has prompted this paper. It is hoped that the brief treatment here given may lead to a more complete study and consequently a better understanding of the nature of the subject by the readers of the *Wisconsin Engineer.* It is intended more especially for those whose experience is yet to be acquired.

Specifications in general are intended to convey to the contractor a perfect understanding of the nature of the materials to be furnished and the work to be performed. Plans consisting of either general or detail drawings may be a necessary accompaniment, but it is the specification which ranks first in importance. Part of the specification may and often does consist of figures showing sizes, etc., and notes of explanation on the drawings, but dependence on these alone will leave room for various interpretations and consequent conflicts of opinion between the engineer and the contractor. It is manifestly unfair to either that any doubt as to the scope or character of the work should exist. If the specification is loosely worded, the contractor in making his estimate interprets the various sections in such a manner as to cheapen the cost, enabling him to make a low bid and secure the work; while the engineer in charge may expect the best of everything and the endeavor to obtain it under a contract, made upon such a basis, will cause constant friction and endless worry. It is well to remember that good work can only be secured at a fair price and from responsible parties. A wide variation in the amounts for which various contractors propose to do a certain piece of work, indicates either an incompetency on the part of the bidders or an incomplete specification, usually the latter. Experience teaches contractors that a loose or imperfect specification means inexperience and ignorance on the part of those in charge of the work, and they realize that this causes unreasonableness with reference to unimportant though often expensive features, and knowing that the really important parts of the work will have to be taken care of in a proper manner whether required or not, reliable men bid high. This either rules them out of the competition or increases the expense of the work. Specifications should be as brief as possible; legal verbiage is entirely out of place. The same point should not be covered twice, nor should two separate clauses occurring at different

places apply to the same thing. It should proceed from a general to a detail description, and above all should stop when the subject is covered. Some specifications show on their face that this is not the case, the author having gone on adding clause after clause, only stopping when the date for awarding the contract arrives, after which the practice is continued in verbal instructions.

The young engineer upon commencing the practice of his profession will find a number of standard specifications for steel and iron. These standard specifications treat of the chemical and physical characteristics of the material as well as the methods of working the same into such shape as to be available in the finished structure. Many of these are the result of a life of experience and research and their authors men of high standing. Owing to the recent extension of the use of these metals and the comparative lack of reliable tests both in the laboratory and the crucial test of actual use, these specifications may differ more or less on minor points. A careful comparison will, however, show that the essential features are in agreement. The exact chemical composition, elastic limit, ultimate strength and elongation required for the various classes of work, show but small variations in the different authorities. As these quantities are more or less dependent upon each other, it is simply a question of what chemical composition and method of treatment will produce the required physical properties, and experience alone can demonstrate their exact relations. The various manufacturers in this country have agreed upon a specification covering these points for the different kinds of material. Their plants are equipped for manufacturing in accordance with these rules, and they can produce material under them of reliable and uniform character.

The foremost engineers in the country have been concerned in the determination of these formulæ, and as experience and practice demonstrate that an improvement can be made, they will be modified. It is manifestly to the manufacturer's interest to produce a thoroughly good article, and it would seem advisable, for young engineers at least, to place considerable reliance upon them—to take the material as it is manufactured and to use it to the best advantage. This insures a reasonable cost as well as a better delivery. It is sometimes the case that an engineer having charge of the construction of work where steel is employed, will specify a chemical composition almost, if not quite, impossible of production. The result is in the first place an increased cost, and next a delay in furnishing the structure which often proves a very serious matter. Instances are not unknown, especially when the mills have plenty to do, when orders have absolutely been refused, when to fulfill the specification would be difficult if not more or less problematic. Such a specification encourages the manufacturer in dishonest methods. He knows that the material called for is no better than his standard article and will sometimes endeavor to substitute the latter. The engineer has the privilege of straining material as much or as little as he may deem proper, and it seems to the writer that the better course to pursue is to take a good article as it comes to us and use it as advantageously as we may, rather than to call for something not to be had and to make ourselves miserable in trying to obtain it.

The workmanship also should be in accordance with recognized good practice which may be obtained from the standard specifications previously mentioned. Bridge and structural iron shops are in general equipped with tools capable of producing work according to the general practice, and the engineer will find that the fewer unusual requirements he puts upon the contractor for this part of the work the more satisfactory will be the result. It is not the intention in this or what has been previously written to advocate any laxity in the specifications. Workmanship consistent with the character and importance of the structure should be insisted upon. There is usually, however, more than one method of accomplishing one and the same result, and it is not necessary to insist that a special method shall be pursued when the customary practice will answer as well. Bad workmanship will probably show itself sooner than any other quality of the finished work, and it will not be long before the engineer using any amount of steel or iron will know what points to guard against. Until that time it is safe to rely upon the general practice in making up a specification. Details should generally be left to the iron contractor. If it is necessary to obtain a standard of excellence which the work must equal, it should be understood only as a guide and such modifications should be permitted as do not impair the strength or appearance of the work and which may better fit the tools used by the shop undertaking the contract.

In writing specifications for iron and steel, no engineer need fear to plagiarize. It is not a crime. Plagiarize freely from the proper sources and deem it rather a mark of ability to properly select your authorities. Originality is not to be aimed at for the purpose of being original. Generally such attempts on the part of the inexperienced men are proofs of ignorance. Neither is it necessary to make a slight change from the usual practice, such a course being almost a sure indication of the fact that the author is either not familiar with the usual practice or is trying to hide incompetence. Another error common in specifications written by such men is the confusion of the various classes of work, good and bad requirements are mixed together. Clauses found only in specifications calling for the highest character of work are found side by side with requirements indicating a poorer grade. Such specifications seem to result from the author's having collected all the available information within his reach and combined it into one production. It is a practice which cannot be too greatly condemned. In general the young engineer should follow in the footsteps of his predecessors except where a deviation is dictated by good and sufficient reasons.

A Simple Form of Gas Regulator.

In a communication to the New York Section of the American Chemical Society, Mr. Ludwig Saarbach described as follows a simple form of gas regulator, that is likely to find favor with those who have occasion to deal with gases in certain experimental ways:

A glass tube, one end of which is blown out to a bulb, is bent around twice, as indicated in Fig. 1, and is provided with a side tube *T*. Some mercury is poured into it, which cuts off a volume of air in bulb *a*. The smaller tube *I*, fitting loosely in the wider tube, is connected to the latter by a piece of rubber tubing, which at the same time allows an up-and-down movement of the small tube. This apparatus is put into the air or water bath, which is to be kept at a constant temperature; its working is effected by the expansion by heat of the volume of air in bulb *a*, which causes the mercury column to rise until it reaches *I*, serving as inlet of the gas. From the space over the mercury column, the gas is conducted through the pipe *T* to the burner. As the

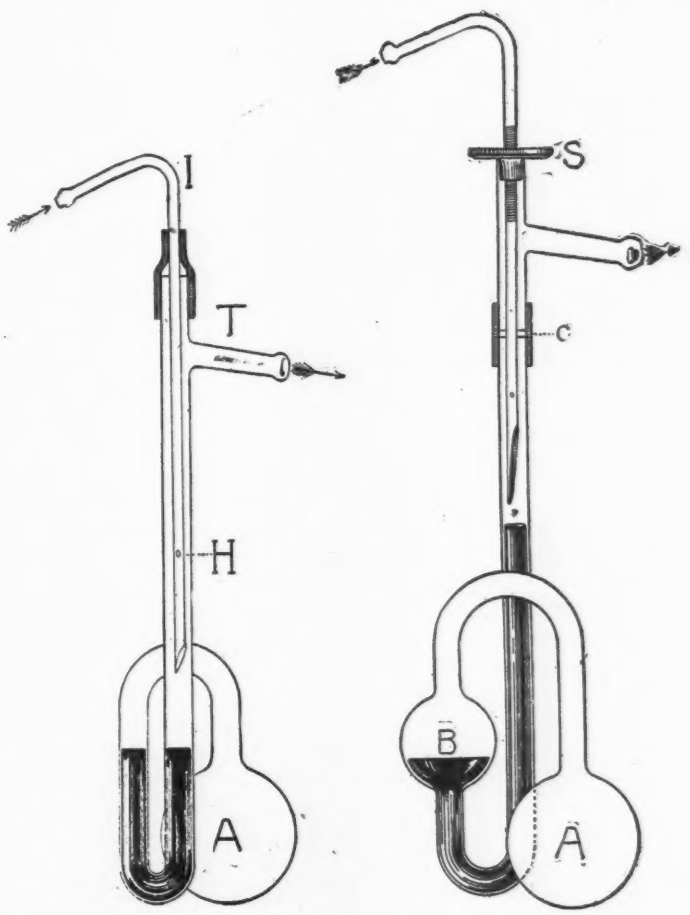


Fig. 1. Fig. 2.

inlet pipe is cut off obliquely or drawn out to a slit, the supply of gas is with increased temperature diminished by and by, and might even be cut off altogether if the pipe were not provided with a small hole *H*, which allows the passage of a sufficient amount of gas to prevent the extinction of the flame. The smaller supply of gas lowers the temperature, and the sinking of the column of mercury caused thereby allows then the gas to pass again freely. It is easy to keep the air or water bath, which is provided with this apparatus, constantly at any desired

temperature within 1° to 2° F. by regulating the position of the inlet pipe. The daily changes in the atmospheric pressure have very slight influence.

As the amount of mercury might at higher temperature not be sufficient to keep back the expanded air, a small bulb might be blown in the second bend (*B*, Fig. 2), and thereby a sufficient supply of mercury for even very high temperatures can be provided. If the apparatus is intended for a closed bath, the main pipe is cut at *C*, the lower part is then fixed from inside and connected outside with the upper part by means of rubber tube. The standpipe *1* may also be regulated by a screw movement *S*.

This apparatus has the advantage of being simple and cheap. It can be used for open or closed baths at either high or low temperatures. The main drawback of all other similar apparatus is the black mass caused by the action of illuminating gas on the mercury, which collects in a short while on the surface of the mercury column and stops the action completely. The apparatus described allows the removal of the dirty mercury and filling anew in the easiest and most rapid manner.

Furthermore, there is no stopcock or rubber tube connection between the working parts—that is, the expanded volume of air and the column of mercury.

The McDonald Hopper for Charging Coal.

On May 5th, 1896, U. S. Letters Patent (No. 559,731) were granted to Mr. Donald McDonald, of Louisville, Ky., for improvements in hoppers for charging coal or coke. Using the words of the specification:

Figure 1 is a perspective view of my improved hopper. Fig. 2 is a sectional view, on the line 2 2, Fig. 1. Fig. 3 is a plan view of the hopper with the cover removed. Fig. 4 is a horizontal section, and Fig. 5 is a detail view of a portion of the lid.

The invention relates to that class of hoppers which are employed for charging coal or coke into a hot gas generator or for charging limestone into a kiln, or it may be used wherever a generator has to be charged against gas pressure.

The object of the invention is to provide a rotary hopper which, when turned in one direction, will cause its lower open end to register with an opening in the base to discharge its contents therethrough, and when turned in an opposite direction for refilling will close the said base openings; also, to provide such a hopper with a close fitting cover, whereby all escape of gas is prevented in both movements of the hopper; also, to provide the lower face of the hopper with a clearing flange in close engagement with the upper face of the base.

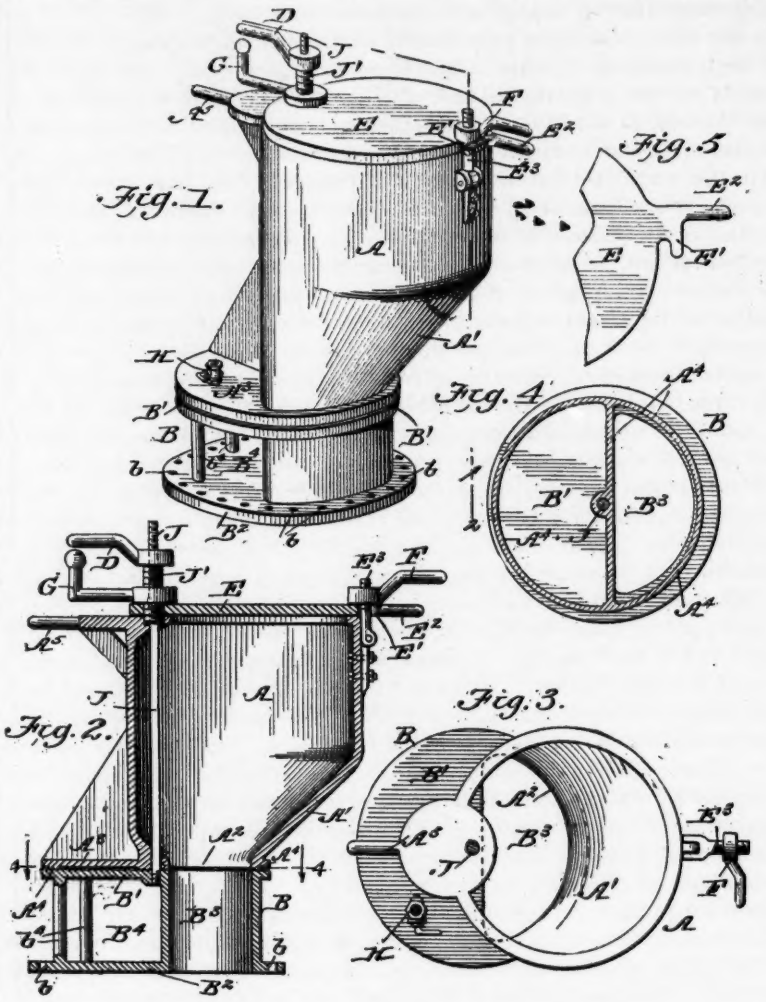
The invention consists in the construction and combination hereinafter described and claimed.

A represents the hopper mounted to turn horizontally on the rod *J*, projecting vertically from the center of the circular base *B*. The rod *J* extends up through the hopper, adjacent to one side thereof, and the opposite side of the hopper is inclined downwardly and inwardly, as at A^1, to the outlet A^2. The bottom of the hopper is formed with a horizontal circular flange A^3, concentric with the hopper axis *J*, and the lower face of this flange A^3 is provided with an annular rib A^4, which rests upon the flat upper side B^1 of the base *B*. This rib A^4 is, however, eccentric to the axis *J*, so that when the hopper is rotated said rib will exert a scraping or clearing action on the base and prevent the accumulation of dust, etc., thus providing for a close joint between the hopper and base to prevent escape of gas. The flange A^3 projects beyond the pivoted side of the hopper, so that when the hopper opening A^2 is partially or entirely out of register with the base opening B^3 the flange will close said base opening. The upper threaded end of the bolt projects above the hopper and is surrounded by a tubular bolt J^1, which is screwed at its lower end into the upper edge of the hopper.

E is the hopper cover or closure, which turns freely on the bolt J^1 and is clamped at that side by means of the handle nut *G*, which screws on the tubular bolt J^1 and against the upper side of the cover. The opposite side of the cover is provided with a hook or recessed lug E^1 and a handle E^2, and this hook or lug engages with the bolt E^3, hinged to the upper front portion of the hopper *A* and provided with a handle nut *F* for clamping that side of the cover down upon the hopper.

D is a handle nut on the upper extremity of the rod *J* and bearing at its lower side against the upper end of the tubular bolt J^1, so that by turning the nut *D* down tight against bolt J^1 the hopper and base *B* will be drawn together and a tight joint formed. The hopper is turned by means of a handle A^5 at the upper end of its rear side.

The base *B* is circular or cylindrical, and its upper face is trued or faced off for engagement with the rib. The upper and lower flanges B^1 B^2 are separated to one side of the opening B^3 by means of the space B^4, which, if desired, may be filled with asbestos or other suitable material, and b^4 are strengthening posts or braces connecting the base flanges within this space. The lower base flange B^2 is provided with bolt holes *b*, by means of which the entire hopper mechanism may be bolted in place. When the parts are in the position shown in Fig. 1, a charge will have been discharged from the hopper through the base opening B^3, and the attendant will now grasp handle A^5 and swing the hopper around so that the opening A^2 will come directly over the space



B^1. and its flange A^3, directly opposite opening A^2, will close the hopper opening B^3. The nuts *F* and *G* will be loosened and the cover swung open. The bolt E^3 will be swung down out of the way of the coal heavers, who will now fill the hopper and again close the lid tightly thereon. The coal in the hopper will be prevented from coking and thereby running together by means of the space B^4, which prevents heating at the hopper and its contents. The nut *D* will be turned down a little if any gas or odor escapes from between the hopper and base. I thus dispense with all cone, slide, plug and other valves, which are liable to become clogged from the dirt and tarry matters in the coal, and my construction of base prevents coking in the hopper, as when filled the hopper always rests over space B^4 until its contents are to be discharged, when it is turned by its handle A^5 to bring its outlet A^2 into register with the base opening B^3 and then immediately returned to its position over space B^4.

H is a sight cock mounted on the flange A^3 to permit the operator to look down into the furnace, oven or kiln to which the hopper is applied.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination with the base formed of upper and lower parallel plates spaced apart, connected at one side of the center by a tubular portion which forms the opening through the base, and connected at the opposite sides of the center by vertical posts or lugs, of the horizontally turning hopper pivoted to the base and having a horizontally flanged lower end resting on the upper plate of the base and adapted to close the base opening when the hopper opening is over the closed portion of the base, and a cover for the upper open end of the hopper and pivoting on the same axis with the hopper, a nut on the hopper axis for bearing down on that side of the cover and means for securing the

opposite side of the cover to the hopper, substantially as and for the purpose described.

2. The combination with the circular base having an opening therethrough to one side of its center, of the horizontally turning hopper pivoted to the center of the base and having a flanged lower end provided with an annular eccentric rib engaging the faced upper side of the base to scrape the same and form a tight joint; the hopper having an outlet to register with the closed or open portion of the base, and a cover or closure for the hopper, substantially as set forth.

3. The combination with the circular base having a central vertical rod and an opening at one side thereof, of the hopper pivoting at one side on said rod, having a bottom flange engaging the upper face of the base to open or close the base opening; the hopper also having an outlet to register with the base opening or the closed portion of the base, a closely fitting cover turning on upper end of the rod, a handle nut for tightening that side of the cover, a hook or lug at opposite sides of the cover, and a hinged bolt and hand nut for engaging said hook or lug and clamping that side of the cover, substantially as set forth.

4. The combination with the base and its vertical rod, of the hopper pivoting on said rod, a tubular nut or sleeve on the upper portion of the rod, the horizontally turning cover turning on the tubular nut or sleeve, a jam nut on said tubular nut or sleeve for clamping that side of the cover, a bolt and nut for clamping the opposite side of the cover, and a jam nut on upper end of the central rod for drawing the hopper and base together, substantially as set forth.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE East Boston (Mass.) Company evidently lost no time in repairing the damage to its property, occasioned by the fire that made things pretty warm for Superintendent Anderson last May. The wharf has been restored, and the new coal shed (which is to have the dimensions of 200 feet in length by 90 feet in width and 30 feet in height) is well along to completion. The walls of the new holder tank (the holder is rated to a capacity of 250,000 cubic feet) will be finished by the 15th inst.

THE backers of the concern, known through its incorporation papers as the Citizens Fuel Gas, Heat and Power Company, have applied to the Common Council of Yonkers, N. Y., for the right to lay mains for the distribution of fuel gas in that city. They agree to furnish fuel gas to ordinary consumers, for cooking and heating purposes, at the rate of 50 cents per 1,000 cubic feet, and further agree to charge not in excess of 25 cents per 1,000 cubic feet for gas used for power purposes—provided the consumption on said account "is large." The preamble of the application also recites: "That the said parties, their successors and assigns, shall deposit with the city authorities a good and sufficient bond in the sum of $50,000, as a security that the streets to be disturbed shall be placed in the same condition as found by them; that the Company will not consolidate for a period of 21 years, directly or indirectly, with the existing Companies; that they agree to begin operations within 60 days from date this franchise is granted, and to complete and deliver its product within 9 months." The application, which is signed by James Jackson, and who in turn is vouched for by John Coyne (a registered Notary Public of Westchester county, N. Y.), was referred to the Committee of the Whole.

THE following is a syllabus of the opinion, prepared by Associate Justice Spear of the Ohio Supreme Court, in the case of the State of Ohio *ex rel.*, against Mr. S. M. Taylor, Secretary of State, in mandamus proceedings instituted to compel that official to permit the Steubenville (Ohio) Gas and Electric Light Company to amend its charter for the purpose of permitting the Company to operate a street railway system:

"1. The duty of the Secretary of State, on presentation of articles of incorporation and tender of proper fees, to file and record such articles, and upon request issue a duly certified copy thereof, is controlled by the statutes of the State, and not by the discretion of the officer.

"2. The authority to amend articles of a corporation given by Section 3238a, revised statutes, is controlled by the proviso which denies the right to change substantially the original purpose of the organization.

"3. To change by amendment a Company incorporated under articles which specify that it is organized 'for the purpose of forming and organizing a manufacturing Company under the laws of the State of Ohio, to engage in the business of manufacturing gas, electricity, and furnishing natural gas for light, heat and power, and for such and other purposes as may be used by the citizens and corporations in Steubenville, Jefferson county, Ohio, and its vicinity,' to a Gas, Electric and Traction Company, with power 'to acquire, open, operate, lease and maintain a street railway in the city of Steubenville, O., to be operated by electricity or other motive power, for the conveyance of passengers, freight, express and mail matter,' over a described route, and extending to such other points within or without, or partly within and partly without that city, as may hereafter be selected, would change substantially the original purpose for which the Company was organized, and is not authorized by the statutes of the State.

"Writ refused and petition dismissed."

A No. 1 Anderson pipe cutting apparatus has been ordered by the City Gas Works, of Alexandria, Va.

THE proprietors of the Oneida (N. Y.) Gas Light Company have at last emerged from the do-nothing state, for we understand that, at a meeting of the Directors held the last week in June, it has been decided upon to construct an entirely new works, even to the ground floor—meaning the site. It is estimated that the expenditure of something over $25,000 will be incurred before the new plant is completed.

THE Providence (R. I.) Gas Company, in a circular issued under date of June 26th, made public the following: "On the 1st of July the price of gas will be reduced from $1.20 to $1.10 per 1,000 cubic feet, and from said 1st day of July, until further notice, a rebate of 5 cents per 1,000 cubic feet will be made to consumers who shall have paid bills on presentation, or within 20 days thereafter during the calendar year, that amount to 1,000,000 cubic feet and upwards—or at that rate for a shorter term, the rebate to be paid at the end of each calendar year."

THE Highlands Gas Company, of Arapahoe county, Col., has been incorporated by Messrs. L. H. Hartman, F. P. Arbuckle and R. H. Porter. It is capitalized in $100,000.

A SPECIAL despatch to the Philadelphia *Press*, dated Wilmington, June 26th, said: "Mr. J. Edward Addicks will have another opportunity to appear in the Delaware courts. He is in trouble with the City Tax Collector, Eugene M. Sayers, and the Oxy-Hydrogen Gas Company, which is a branch of the Bay State Gas Company. The plant has been an elephant on the gas king's hands for several years, because he has never been able to get the right to lay pipes in the Wilmington streets. The plant is situated along the line of the Philadelphia, Wilmington and Baltimore Railroad, not far from the works of the Harlan & Hollingsworth Company. The city taxes on it for 1894 amounted to $422. They were not paid in 1894 or 1895, and this year Collector Sayers decided to have the money. He waited on Mr. Addicks, who refused to pay, even when the Collector threatened to sell the large plant for such a paltry sum. Collector Sayers placed the matter in City Solicitor Harmon's hands, and instructed him to sell the place out. The City Solicitor has taken the matter to the court house, and unless payment is made Prothonotary Woolley will issue a writ and place it in the hands of Sheriff Gillis, who will levy upon and sell the plant. Mr. Addicks' counsel will resort to injunction proceedings to prevent the sale. Mr. Addicks claims that he is prevented from operating his plant, and therefore will not pay taxes on it."

THE Milwaukee (Wis.) Company's plant, which adjoins the Company's old station in the Third Ward, is in working order. It has a daily capacity of 2,000,000 cubic feet, and, if memory is to be trusted, we believe the Company is now equipped to meet a daily demand on its resources for 6,000,000 cubic feet.

IT is reported that Mr. Peter English, of Benton Harbor, Mich., and Mr. W. H. Berkey, of Grand Rapids, Mich., propose to establish a fuel gas plant at Kalamazoo, Mich.

MRS. ANNA MCDOWELL, through her attorneys, Messrs. Butler, Burgess & Butler, has entered suit against the Consolidated Gas Company, of Baltimore. She asks for damages in the sum of $2,500 for personal injuries caused by "violent contact" with a horse and wagon owned by defendant.

WE understand that the New Brunswick (N. J.) Company will return to the manufacture of coal gas—in part, at least. In any event, the Company has received bids for the construction of 5 benches of fives.

THE gas works operated in connection with the U. S. government post at West Point, N. Y., are to be enlarged as to generating capacity.

SUPERINTENDENT ROSS, of the Perth Amboy (N. J.) Gas Light Company, is a busy man these days, overseeing the plant improvements underway at that point. We have it, too, on pretty good authority, that the Hon. John Kean, Jr., the leading spirit in the gas supply of Elizabeth and Rahway, N. J., has acquired a good block of stock in the Perth Amboy Company.

MR. D. L. HOUGH has satisfactorily completed the pipe laying contracts awarded him by the Consolidated Gas Company, of New Jersey.

THE Directors of the New Orleans (La.) Gas Light Company have declared a dividend of $4 per share out of the earnings for the six months ended June 16th. The dividend checks will be mailed on the 15th inst.

THE Interstate Gas Company, of Toledo, Ohio, has filed incorporation papers. The capital stock of the concern is $150,000.

THE proprietors of the Woodhaven (L. I.) Gas Company have applied to the Board of Supervisors of Queens county for permission to lay mains in the village of Richmond Hill. The Board referred the application to its Counsel, Mr. J. R. Scudder.

MR. GARRET A. HOBART, the candidate for Vice-President of the United States on the Republican ticket, is beyond doubt a gas man, for besides his connection with the Peoples Gas Light Company, of Paterson, N. J.—which connection was noted in the JOURNAL for last week—his affiliation with the industry is further proved through his membership in the Board of Directors of the Norwich City (Conn.) Gas Company.

ELSEWHERE we note the incorporation of the Highlands Gas Company, to operate in Highlands, Arapahoe county, Colorado; and the following from a correspondent at Denver, respecting the named Company, throws additional light on the scheme: "At a meeting of the City Council of Highlands, held June 23d, an ordinance was passed granting to the Highlands Gas Company the right to use the streets and alleys for the purpose of laying mains and service pipes for the distribution of gas and to operate a plant for the manufacture of illuminating and fuel gas. Frank Arbuckle, the promoter of the franchise, was asked last evening if it was proposed to erect a gas plant in Highlands, but he refused positively to have anything to say about the matter. A resident of Highlands volunteered the information that it was a 'selling franchise.' He said there was only one place he knew where gas was wanted, and that was at the home for consumptives; that hardly any buildings were piped for gas, and the population was so scattered that not enough gas would be consumed to pay for distributing it generally."

THE contract for replacing the holder of the Laclede Gas Company, of St. Louis, Mo., that was wrecked during the recent storm at that point, has been awarded to Messrs. Bartlett, Hayward & Co.

THE transfer of the properties and franchise of the Davenport (Iowa) Gas Light Company to those who have been bargaining for them for some time still hangs fire. It is asserted, however, that the transaction will be completed this week.

THE Seymour Manufacturing Company, of Seymour, Conn., is enlarging its boiler house. The addition to the present buildings will be constructed entirely of steel, so that it will be absolutely fireproof. The contract for the steel work has been awarded to the Berlin Iron Bridge Company, of East Berlin, Conn.

MR. W. H. BAXTER, Treasurer of the Petersburg (Va.) Gas Light Company has notified the shareholders that a dividend of 4 per cent. on the capital stock is payable on demand.

A RECENT issue of the *Journal für Gasbeleuchtung* contains a description of a plan designed by Mr. Gaston Kern, Manager of the Colmar (Germany) Gas and Water Works, for the operation of a street railroad by means of gas power. Referring to the gas operated road at Dessau, Mr. Kern notes that said road has been carried on in most satisfactory manner since October, 1894; and in point of speed the cars are fully up to the requirements. In appearance, as to their interiors and exteriors, and with respect to weight as well, the cars are similar to those moved by electricity. One decided advantage of the gas operated road is that all cars are independent of each other, wherefore, during the hours of heavy travel, additional cars can be put in service at very short notice. Then, too, there is no such thing as the whole line being thrown out of use by an accident or breakdown at a central station powerhouse, as in the case of cable or electrically moved cars. He further says that it is incontestably true that the cost of construction and maintenance of the gas operated road is much less than that of any other system, and he believes that, had the gas system for railroad operation been better known prior to the period in which the cable and electrical types were being pushed, gas operated roads would outnumber those of any other system. He names three eminent railway engineers who estimate that the cost of a surface street railway equipped for electricity would be $36,176 per mile, whereas a road equipped for gas operation would cost but $28,560 per mile—as a matter of fact, the cost of the gas road at Dessau was only $27,798.40 per mile. A 10-horse power gas tramway car uses about 32 cubic feet of gas per car mile.

THE New York *Herald* of June 29th had this to say respecting the efforts of certain people behind the Mutual Gas and Electric Company (a rather diaphanous corporation that would like to supply gas in Brooklyn, N. Y.) to have the State declare that the amalgamation of the gas interests of Brooklyn, which resulted in the formation of the Brooklyn Union Gas Company, is void because of illegality: "John C. Lester, through his attorneys, filled a petition with the Attorney General in Albany, asking that the charter of the Brooklyn Union Gas Company be annulled on the ground that the Company is an illegal combination. With this are concerned the Williamsburgh Gas Company, Fulton-Municipal Gas Company, Nassau Gas Light Company, Peoples Gas Light Company, Metropolitan Gas Light Company, Citizens Gas Company and the Brooklyn Gas Light Company. The petition asserts that prior to November 4, 1895, all these Companies, except the one first named, were operating their plants and supplying gas for public and private use in the city of Brooklyn. Their franchises were granted with the intent that there should be competition in manufacturing and supplying gas, and that no one Company should have a monopoly nor the power of charging the highest price allowed by law. Up to that date the Companies were in competition and in many instances supplied gas along the same street, two or more Companies often having parallel lines. On this account gas was supplied cheaply, the price being cut to 90 cents per 1,000 cubic feet. But, the petition asserts, prior to September 5, 1895, these Companies, with the intention of evading the laws of the State against monopolies and trusts, to restrain trade and prevent competition, and unlawfully combine in a monopoly caused a new Company to be incorporated under the name of the Brooklyn Union Gas Company, with a capital stock of $15,000,000. The object of this, the petition says, was to deteriorate the quality of the gas, to increase the price and to compel the consumers to take gas of a quality which the Company saw fit to deliver, at a price which it thought proper to charge. Then the Companies caused to be conveyed to the Brooklyn Union Gas Company all property, rights, privileges, immunities, franchises and assets of the Companies. The Brooklyn Union Gas Company pretended to pay therefor $15,000,000 par value of its capital stock and $15,000,000 of its consolidated mortgage bonds. As a matter of fact, however, the petition says, no consideration was given for such a transfer, but the stock and bonds were deposited in New York, to be turned over to the stockholders of the old Companies. The petition maintains that this act was clearly illegal, and that as a result, competition in the manufacture and supply of gas in Brooklyn has been wholly stifled, the use of certain pipes has been discontinued and the work in some of the plants has been given up. Since the combination, it is asserted, the gas has been of inferior quality and the price has been raised to $1.25 per 1,000 cubic feet, the maximum allowed by law. Before the consolidation consumers were allowed to discontinue the purchase of gas from one Company if the quality were bad and to compel another Company to furnish them with gas of a better grade."

THIS move is merely intended to furnish an opening for the Mutual Gas and Electric Company to display its opposition wares, the show of which so far has failed to attract favorable recognition from the Brooklyn Board of Aldermen, which body has been repeatedly importuned to grant the Mutual's projectors "freedom" in respect of the streets.

AT the annual meeting of the shareholders of the Shelbyville (Ind.) Gas Light Company, to be held at 3 P.M. to-day, the question of ordering important plant extensions will be discussed.

Economy in Central Station Lighting Plants.

Engineering Magazine notes that the report of the committee on data of the National Electric Lighting Association (*Engineering News*, May 14) is an important document. It is safe to say that it will attract the attention of electrical and mechanical engineers throughout the world. The bulk of the information in this report is presented in tabulated form, and the data are sufficient for determining the question of economy of power generation. The charts of load lines, of which there are three, have been constructed from 30-minute readings from meters, or estimated from voltage and amperes.

Economies are presented from 82 central stations, some of which are the largest in the country, "five of them having an output of over 10,000,000 watt hours per day, and 45 having an output of from 1,000,000 to 10,000,000 watt hours per day." The data compiled from 81 central stations show an average efficiency of 108 watt hours per pound of coal. One station uses oil fuel, and produces 1,117 watt hours per gallon of oil consumed. Steam production did not receive the general attention that was paid to other subjects embodied in the circular of inquiry sent out by the committee. Only 31 stations reported upon this point. The highest report was 10.5 pounds of steam per pound of semi-bituminous coal burned; the lowest report is 4.66 pounds of water evaporated per pound of bituminous coal; and the general average of the 31 reports is 7.09 pounds of water evaporated per pound of coal burned.

One of the triple expansion engines averages 1 indicated horse power with 18 pounds of water. The committee concludes that the question of economy is "as much a question of management and manipulation as of the type of machinery used," and, in the final paragraph of the report, repeats "a former statement that the economy secured in generating power for electrical work does not compare favorably with the production of power for other purposes, and that this is also true after taking into consideration the variation in load due to electrical work." Referring to a recent statement of the economy of the Chestnut Hill Pumping Station, at Boston, it was found that, in actual water lifted, a horse power was produced by the consumption of 1.34 pounds of coal; allowing that the efficiency of pumps compares favorably with the efficiency of the generators, and making no allowance for variation in load, 1 pound of anthracite coal used with the same economy in electrical work should produce 557 watt hours. The load line charts "show a fair average of the variation in electrical work, line 3, chart 1, dropping from 1,800 kilowatts at 6 P.M. to 250 at midnight; yet the changes seem, as generally true in electric lighting, to be fairly uniform, and a station planned with the proper units for the work should operate the much larger percentage of its generating appliances on a fair basis of economy, bringing the record in this work much nearer the standards of efficiency in other lines."

The Market for Gas Securities.

Under a fierce bear drive values were smashed right and left this week, the net result in Consolidated being a loss of 5¼ points since time of last writing. There is no earthly reason for this shrinkage, for the Consolidated Company was never on a stronger financial footing than it is at present. Real values, however, count for little during movements such as that which seems to have culminated on the 2d inst. The opening price to-day (Friday) was 153 to 153¼. Equitable is offered at 203, and it is worth at least 10 points more. Mutual remained steady. All other city shares are weaker. Brooklyn Union sold down to 90, having been affected by the ruling adverse temper, and by the movement of certain moon-affected speculators in lawsuits to have the amalgamation agreement set aside, on the ground that it is contrary to law and public policy. The stock would be an investment at par.

Chicago gas shows a net loss of about 8½ points. It came in this morning at 57⅞ to 58. It is worth 75, if it is worth 1. Bay State is dull and lower at 20 to 20½, which remark is also applicable to Lacledes. Every gas share on the list is cheap at current quotations, no matter what is to be the outcome of the monetary standard agitation.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 Wall St., New York City.

July 6.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	152	154
Central	500,000	50	150	..
" Scrip	220,000	..	100	.
Equitable	4,000,000	100	..	203
Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	225	235
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
Northern	150,000	50	79	80½
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	35	36½
Preferred	2,000,000	100	..	74
Bonds 1st 5's	3,500,000	1,000	100½	101
" 1st Con. 5's	1,500,000	..	90	91½
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	77	79
Preferred	5,000,000	100	104½	106½
Bonds, 1st Mortgage, 5's	1,500,000	1,000	110	112
Yonkers	299,650	50	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	89	90
" " Bonds (5's)	15,000,000	1,000	106½	..
Bay State	5,000,000	50	20	20¼
" Income Bonds	2,000,000	1,000	..	42
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	84	85
2d " " "	3,000,000	1,000	66	70
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co.	25,000,000	100	57⅞	58
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds.	7,650,000	1,000	94	94¼
Columbus	1,069,000	..	..	65
1st Mortgage	1,085,000	..	..	96
Consumers, Jersey City	2,000,000	100	..	80
" Bonds	600,000	1,000	99	101
Cincinnati G. & C. Co.	7,000,000	100	198¾	200
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	41
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	1,000,000	100	61	63
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000	..	32	33
" Con. Bonds	4,312,000	..	..	82
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	85	90
" Bonds	2,000,000	..	90	95
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	132	136
" Bonds, 6's	2,650,000	..	104	105½
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	90	95
Bonds	1,000,000	1,000	92	95
Louisville	2,570,000	50	..	130
Laclede, St. Louis	7,500,000	100	20⅝	20¾
Preferred	2,500,000	100	80	83
Bonds	9,084,400	1,000	92	92½
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	98	98
Bonds, 6's	4,000,000	..	123	..
New Haven	1,000,000	25	325	..
Oakland, Cal.	2,000,000	..	52	53¼
" Bonds	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	2,100,000	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Paterson, N. J.	.....	25	99	102
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	83	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	94½	95
St. Paul Gas Light Co.	1,500,000	100	67½	70
1st Mortgage, 6's	650,000	..	84	87
Extension, 6's	600,000	..	..	..
General Mortgage, 5's	2,400,000	.	88	90
Syracuse, N. Y.	500,000	25	..	..
Washington, D. C.	2,000,000	20	250	..
Western, Milwaukee	4,000,000	100	62	65
Bonds, 5's	3,556,000	.	87	90
Wilmington, Del.	500,000	5	188	190

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DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO., DREXEL BUILDING, PHILA., June 25, 1896.

The Directors have declared a quarterly dividend of 2 per cent. ($1 per share), payable on July 15, 1896, to stockholders of record at the close of business July 1st. Checks will be mailed.

1099-3 EDWARD C. LEE, Treas.

OFFICE OF THE LIGHTHOUSE BOARD, WASHINGTON, D. C., June 22, 1896. Proposals will be received at this office until 12 o'clock M., on Monday, the 13th day of July, 1896, for furnishing gas lighting apparatus for the ship channel lights, Mobile, Ala., regulators, piping, burners, gas compressor, boiler, etc., and for performing all labor necessary to completely erect these materials, partly on the Beacons of the Mobile Ship Channel and partly on a barge in Mobile Harbor, Alabama. The right is reserved to reject any or all bids, and to waive any defects. Forms of proposal, plans, specifications, and other information may be obtained on application to this office.

1099-2 THE LIGHTHOUSE BOARD, Washington, D. C.

Position Wanted

By a man 23 years of age

In a Coal or Water Gas Works.

Can read and set meters, lay mains, run services, set gas stoves, etc. Can furnish the best of references. Address

1100-4t "D.," care this Journal.

Position Desired

By a man 24 years of age, who thoroughly understands his business (coal or water gas), also office work in all its details. Is at present in charge of a works, but for good reasons wishes to make a change. Has had 10 years' experience, and is not afraid of work. A position preferred where good service would be appreciated; salary is a secondary consideration. Best of references. Address

1099-3 "ENGINEER," care this Journal.

Position Wanted

As Superintendent of Gas Works or Gas and Electric Light Works.

Has been in the employ of the Long Branch (N. J.) Lighting Company as Superintendent for the last 11 years, and is a practical mechanic, thoroughly understanding the laying out and erection of plant and the making of coal and water gas. Best of references. Address CHAS. J. LUTHER,

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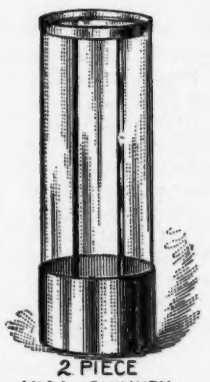

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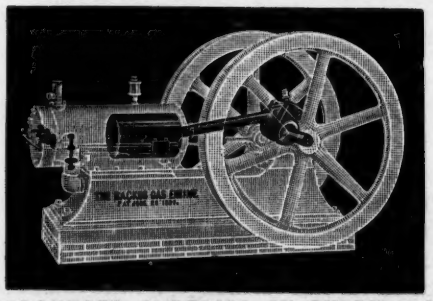

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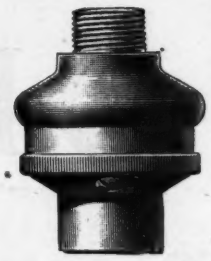

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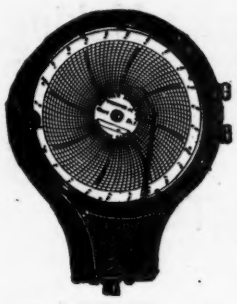

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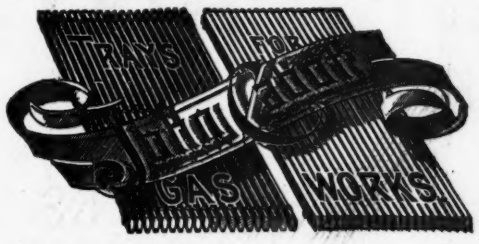

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And the Utilization of Waste Products in Gas Manufacture

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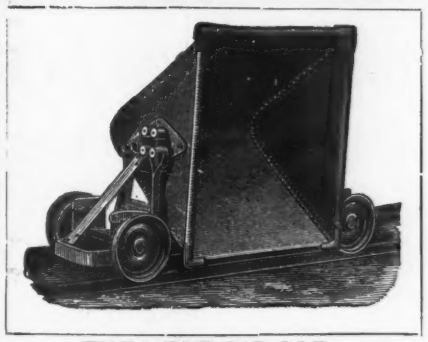

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COKE CARS for Gas Works,
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INDUSTRIAL RAILWAYS
Specially designed for handling material in and around
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THE ANDERSON Patent Cutter Carrying Link
Made in all sizes.

Will cut from 2 in. to 24 in.
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For Cutting Cast, Wrought Iron, Gas & Water Pipes.
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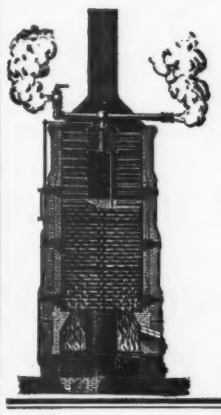
The Pioneer Vertical Water-Tube Boiler of the World!



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After Sixteen Years of Active Service in all the Principal Industries, this Boiler has Proven Itself Superior to all Others in Economy of Fuel, Durability, Safety and General Efficiency.
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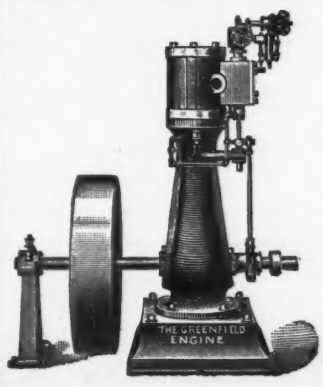
Tele., "1229-18th St.," New York.
Gen'l Office, 716 E. 13th St., N.Y., U.S.A.



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ENGINES AND BOILERS.
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Sizes from 3 to 75 Horse Power.
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The attention of Gas Managers is particularly called to the many improvements in this method of manufacture instituted during the past fifteen years, and the extremely low cost at present of Coal Gas.

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BEWARE of counterfeit lights which are being offered in genuine Welsbach boxes. See that each box bears our trade mark, "WELSBACH," and that the seals are unbroken before you accept it.

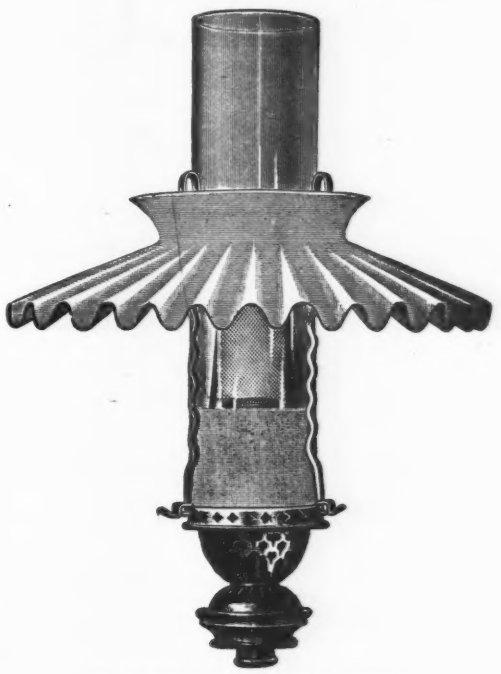
CAUTION!!

Persons dealing in counterfeit lights are liable to criminal prosecution, and a large number of indictments have already been found against such dealers.

All infringements of this Company's patents will be promptly and vigorously prosecuted, dealers and users being equally liable. This Company will prosecute all parties in whose possession infringing lights are found.

This notice is given in view of an effort now being made to introduce into this country infringing lights made in Germany, the sale of which, there, has been prohibited by the recent decision of the German Patent Office sustaining the validity of the Welsbach patents.

For your own protection, see that you get the genuine Welsbach light, as both the counterfeit and the infringing lights are greatly inferior.



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The Vulcan Combination Hot Water Boiler.

FOR GAS AND COAL. ECONOMY IN CONSUMPTION LOWEST ON RECORD.

Can be Connected with Coal Range or Run Independently by Gas.

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With the double connection, hot water can be obtained from the use of the coal range or independently by using gas attachment.

Takes up no more room than the ordinary boiler, which it supplants entirely.

There is always complete circulation with the coal range, and also the coil which is heated by the gas

When the gas is used hot water can be drawn *from any part of the house in three or four minutes* after the gas is lighted.

For instantaneous results the consumption of gas is 24 feet per hour. When a continuous supply of hot water is required for the ordinary family use the consumption of gas need not exceed 48 feet per day.

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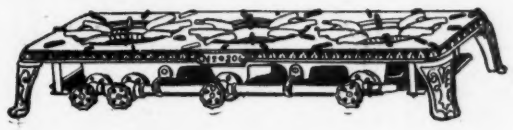

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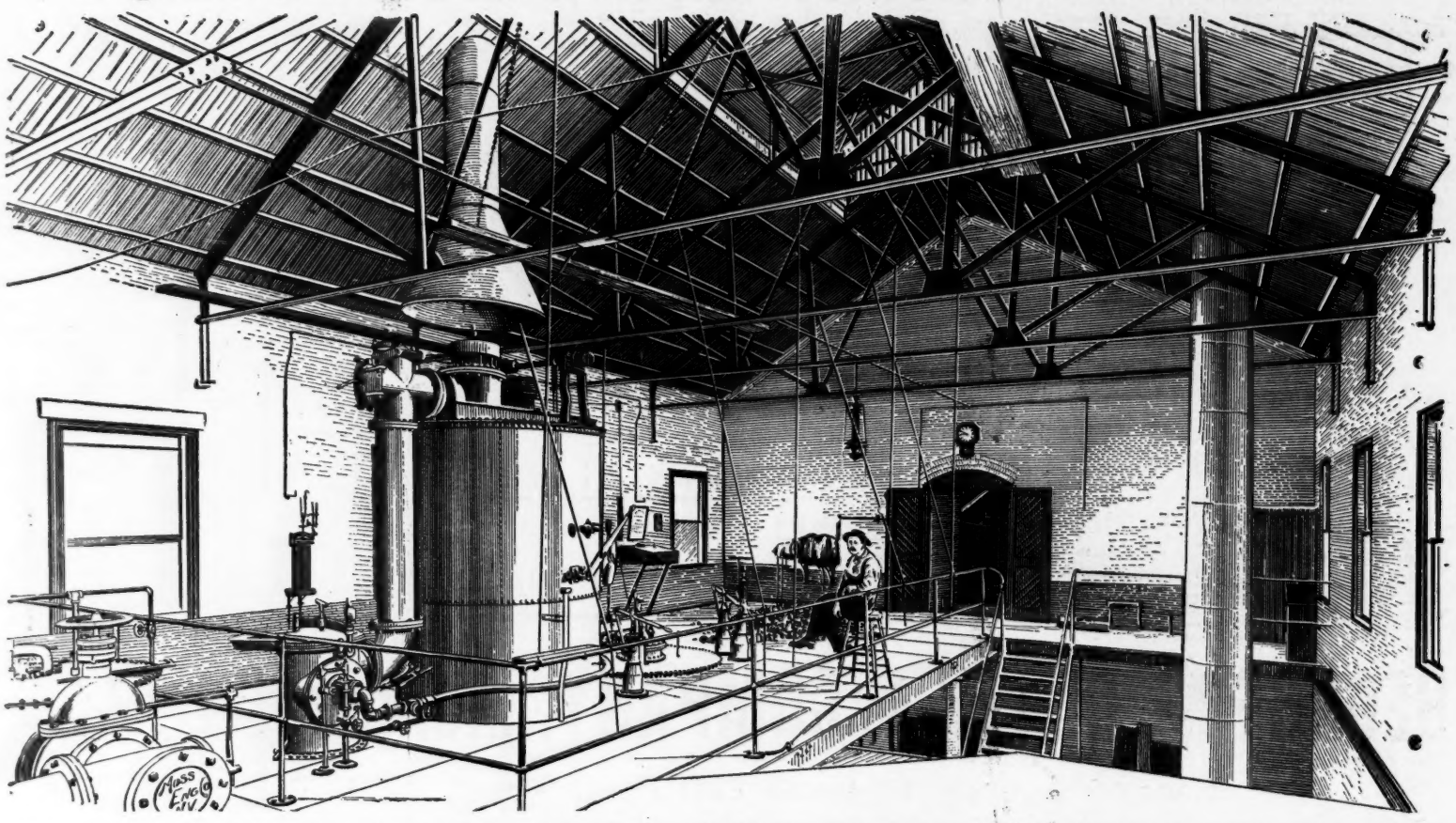

The above illustration is taken direct from a photograph, and shows the Machine Room of the New Bedford Gas Co., at New Bedford, Mass. The Roof of this building was furnished by us. The building is 32 feet wide by 150 feet long, the Roof being made entirely of iron—that is, iron trusses and iron purlins covered with corrugated iron. The room is ventilated by a wrought iron ventilator extending the full length of the building, with corrugated Iron shutters on each side opening and closing by cords from the floor.

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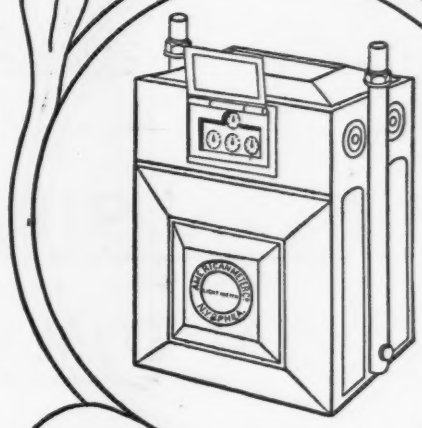
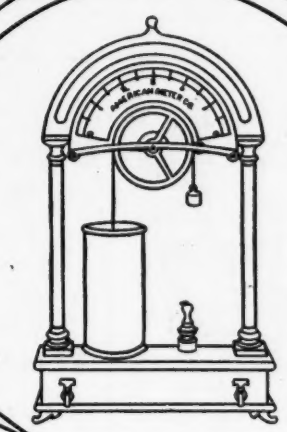
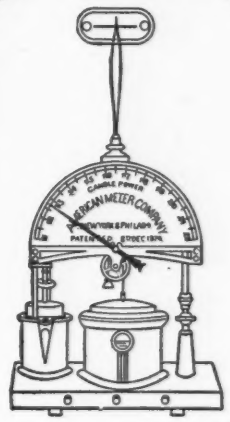


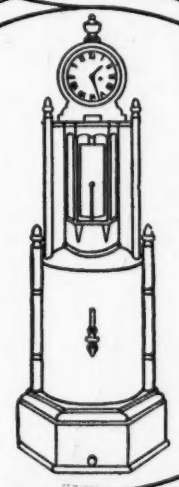


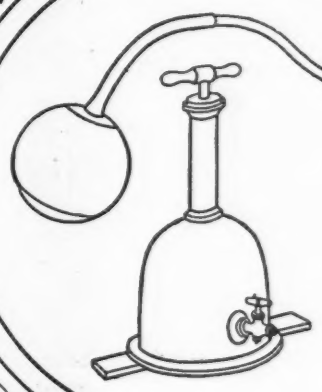


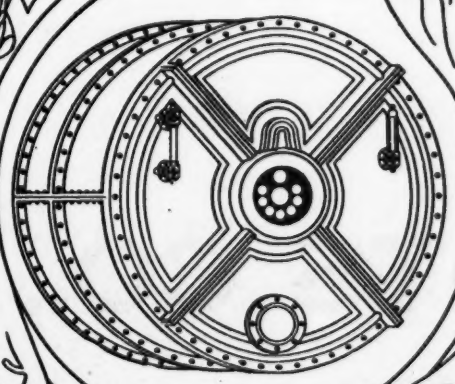
PUBLIC LIGHTING TABLE.

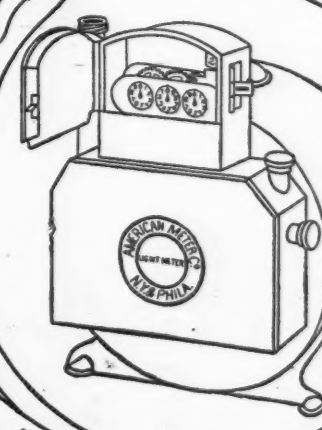
JULY, 1896.

Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
				P.M.	A.M.
Wed.	1	8.00 PM	12.00 AM	7.30	3.15
Thu.	2	8.00 LQ	12.30	7.30	3.15
Fri.	3	8 00	12.50	7.30	3.15
Sat.	4	8.00	1.10	7.30	3.15
Sun.	5	8.00	1.40	7.30	3.15
Mon.	6	8.00	2.20	7.30	3.15
Tue.	7	8.00	3.40	7.30	3.15
Wed.	8	8.00	3.40	7.30	3.15
Thu.	9	8.00	3.40	7.30	3.15
Fri.	10	8.00 NM	3.40	7.30	3.15
Sat.	11	8.00	3.40	7.30	3.15
Sun.	12	8.00	3.40	7.30	3.15
Mon.	13	8.00	3.40	7.30	3.15
Tue.	14	8.00	3.40	7.30	3.15
Wed.	15	9.10	3.40	7.30	3.15
Thu.	16	9.40	3.40	7.20	3.15
Fri.	17	10.10 FQ	3.40	7.20	3.15
Sat.	18	10.40	3.40	7.20	3.15
Sun.	19	11.20	3.50	7.20	3.15
Mon.	20	12.10 AM	3.50	7.20	3.15
Tue.	21	1.10	3.50	7.20	3.15
Wed.	22	2.20	3.50	7.20	3.15
Thu.	23	No L.	No L.	7.20	3.15
Fri.	24	No L. FM	No L.	7.20	3.15
Sat.	25	No L.	No L.	7.20	3.15
Sun.	26	7.50 PM	9.30 PM	7.20	3.15
Mon.	27	7.50	9.50	7.20	3.15
Tue.	28	7.50	10.10	7.20	3.15
Wed.	29	7.50	10.30	7.20	3.15
Thu.	30	7.50	10.50	7.10	3.30
Fri.	31	7.50	11.10	7.10	3.30









TOTAL HOURS LIGHTING DURING 1896.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	220.40	January	423.20
February	207.00	February	367.40
March	193.00	March	355.35
April	174.10	April	298.50
May	164.00	May	264.50
June	142.10	June	234.25
July	142.10	July	243.45
August	150.50	August	280.25
September	163.00	September	321.15
October	193.10	October	374.30
November	207.00	November	401.40
December	237.30	December	433.45
Total, yr.	2194.40	Total, yr.	4000.00

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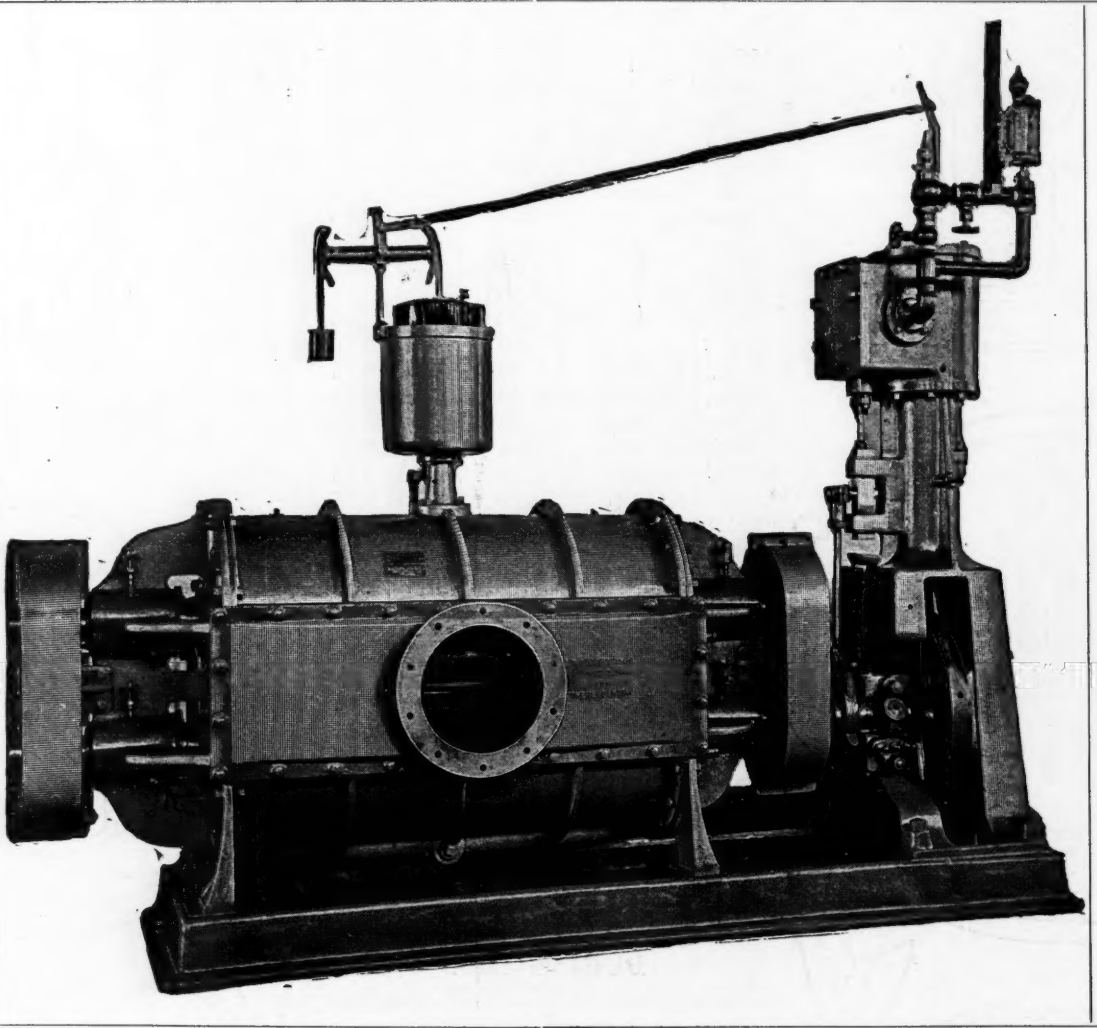
GAS EXHAUSTERS. BYE-PASS VALVES.

AUTOMATIC GAS GOVERNORS.

GAS VALVES. PIPE FITTINGS.



New Design of Direct Connected Engine and Exhauster on Same Bedplate.

This Design is Used for all Exhausters from No. 7 to No. 10, Inclusive.

Write for Illustrated Catalogue.
Estimates submitted on application.

P. H. & F. M. ROOTS CO.,

Connersville, Indiana.

New York Office, 109 Liberty Street, J. B. STEWART, Manager.

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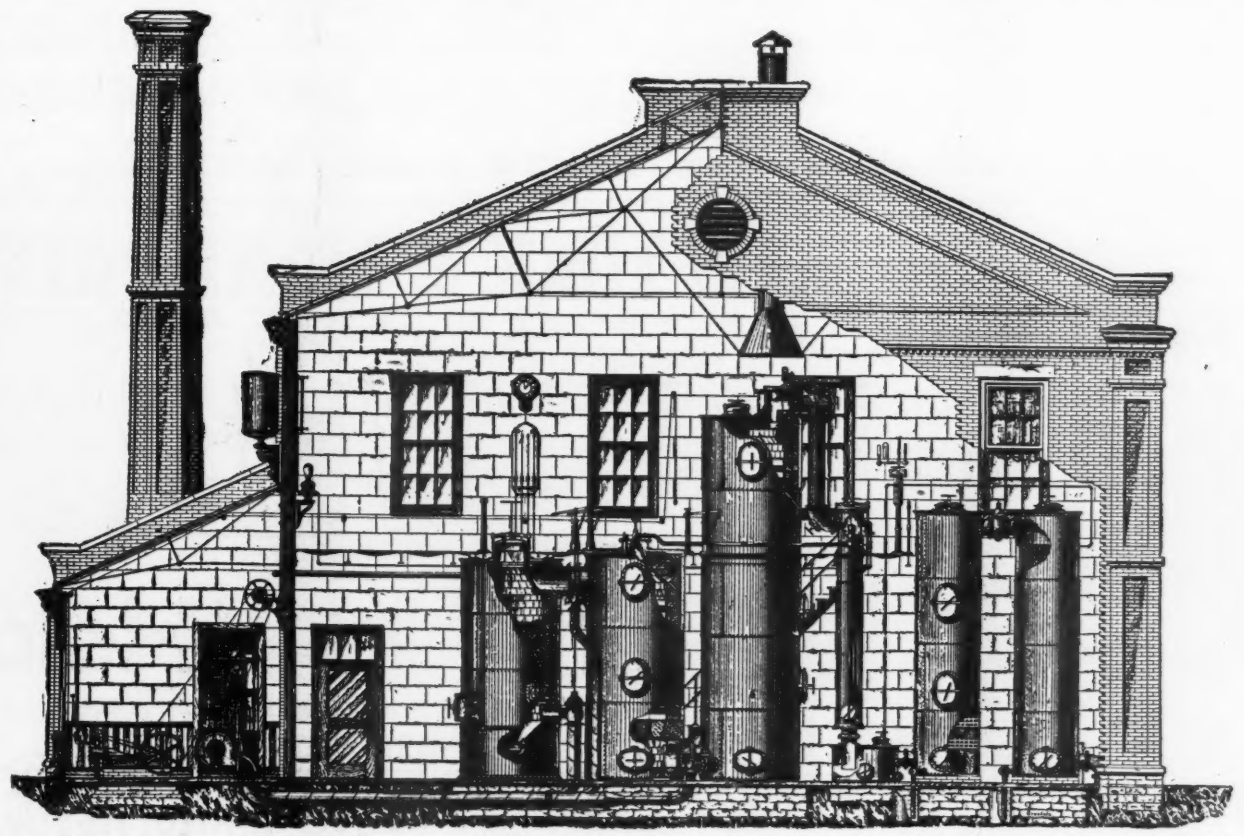
DREXEL BUILDING, PHILA., PA.

Inquiries from any part of the United States should be addressed to the Philadelphia Office.

BUILDERS OF

THE STANDARD LOWE WATER GAS APPARATUS.



Standard "Double Superheater" Lowe Apparatus, designed for the use of Naphtha, Crude Oil, or "Distillates."

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Water Gas Plants, either independent or auxiliary to Coal Gas Works, erected to meet any conditions. Apparatus designed to use any grade of Oil. and Anthracite Coal, or Gas House or Oven Coke.

PAMPHLETS, PLANS AND ESTIMATES FURNISHED UPON APPLICATION.

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ENGINEERS and BUILDERS,

FORT WAYNE, INDIANA.

Water Gas Apparatus . . .

Improved Double Superheater Settings,
Improved Single Superheater Settings,
Special Designs for Small Works.

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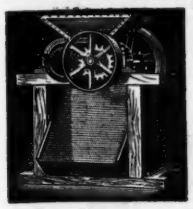

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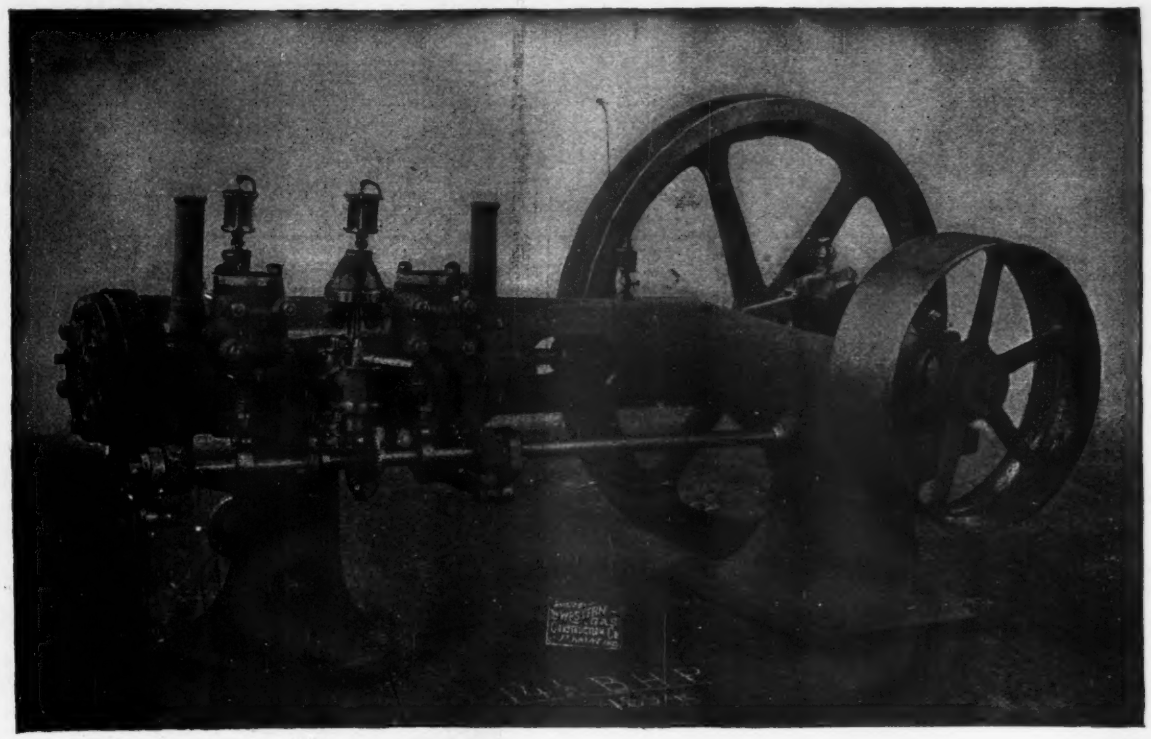

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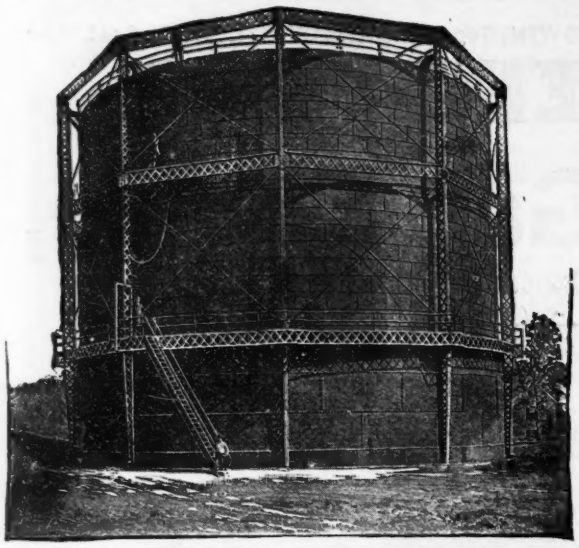

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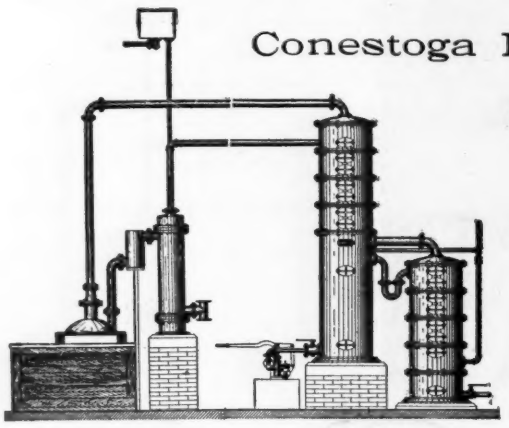

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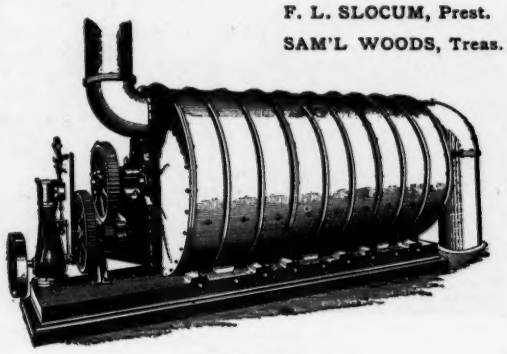

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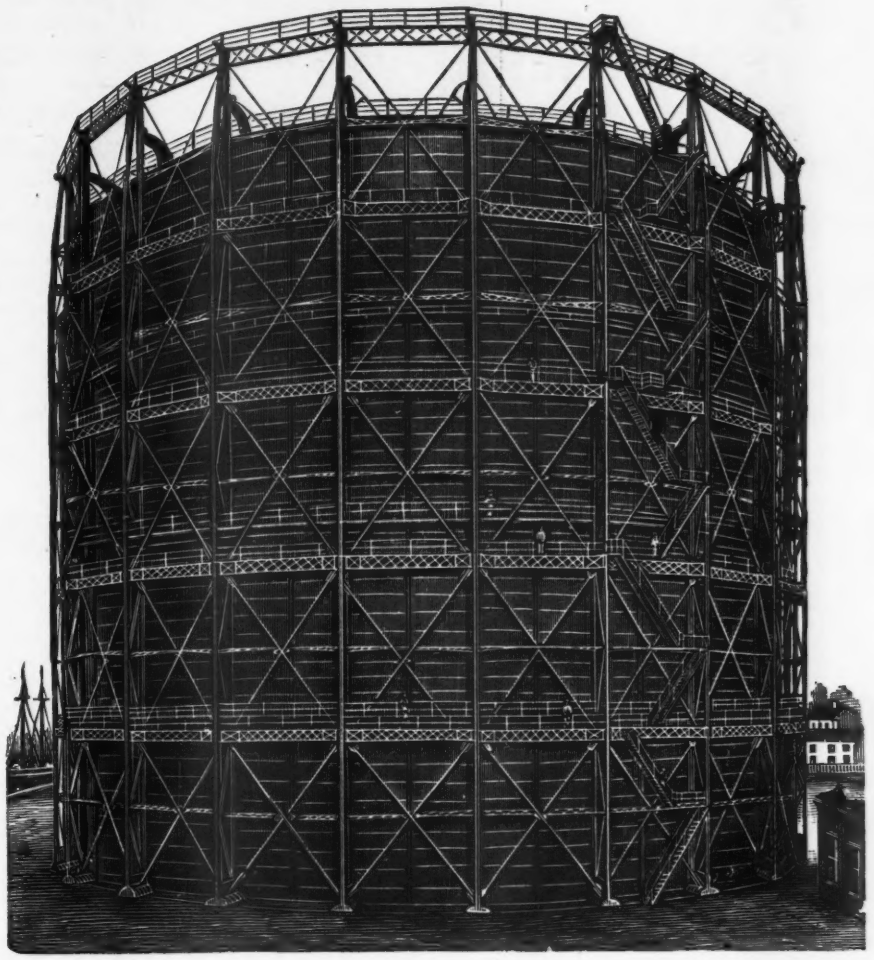

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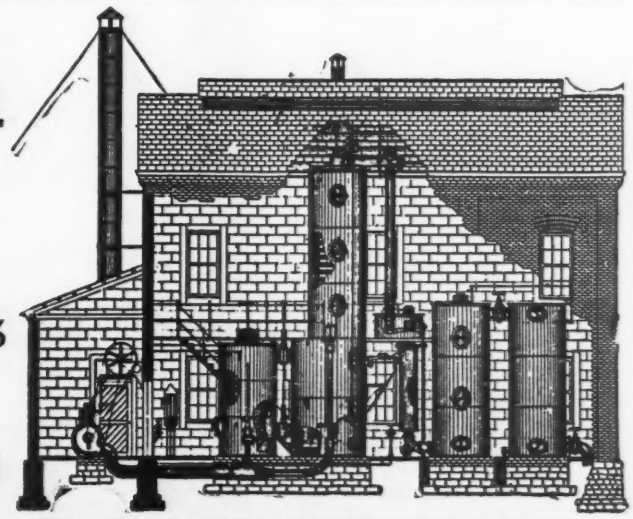

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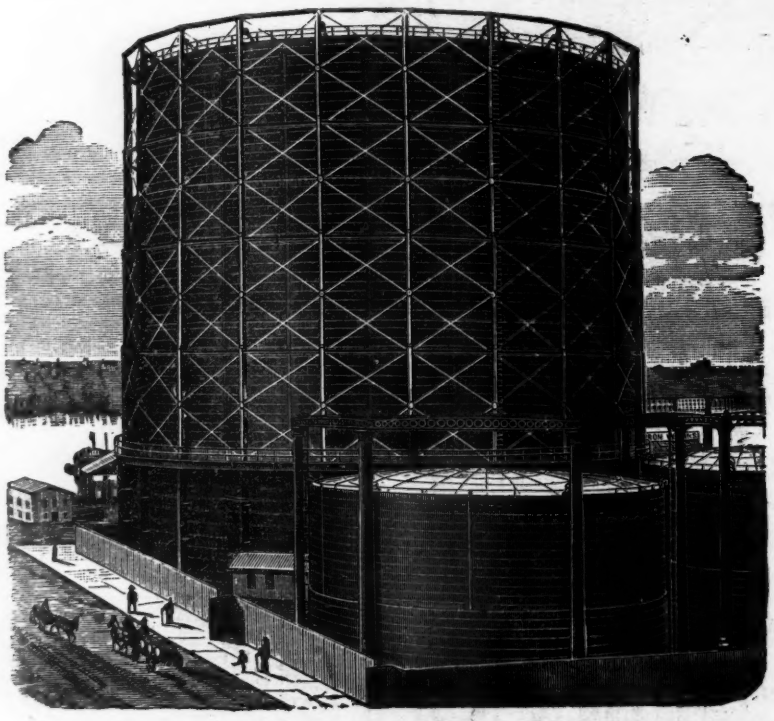

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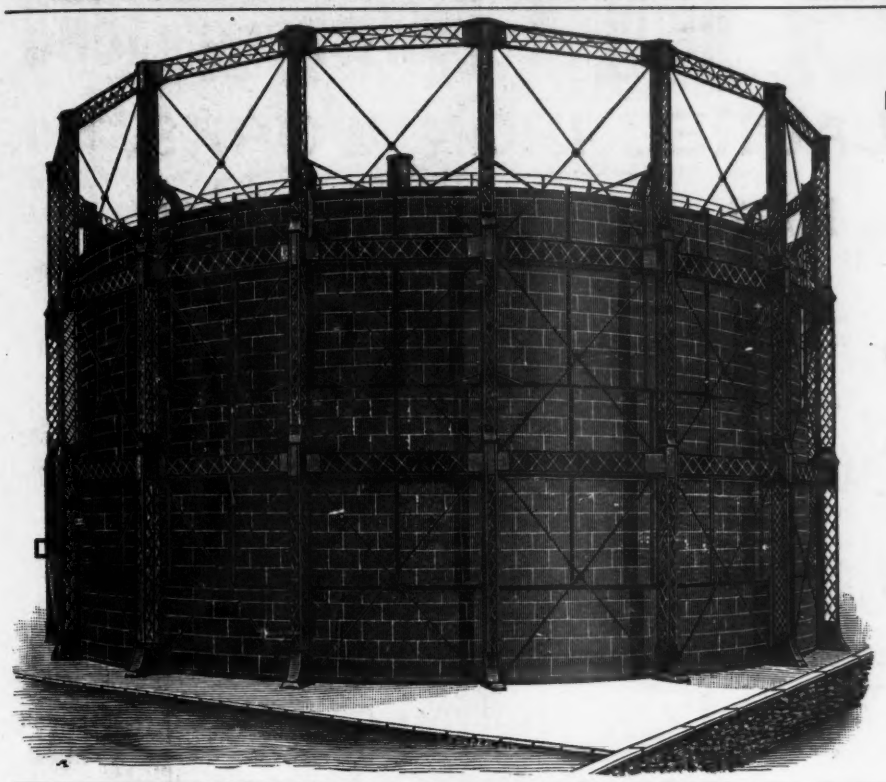

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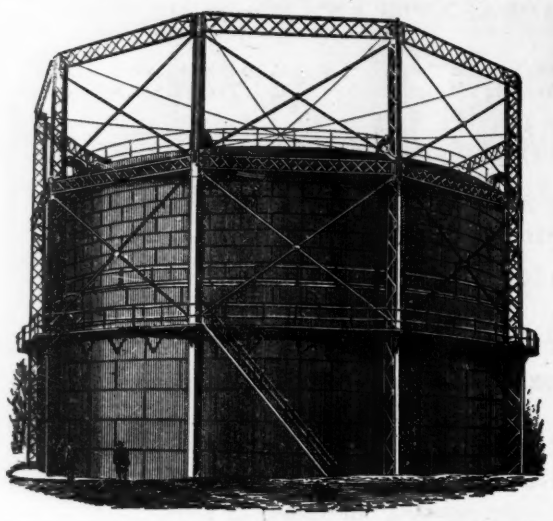

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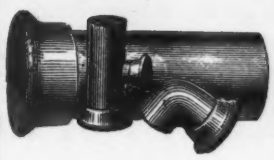

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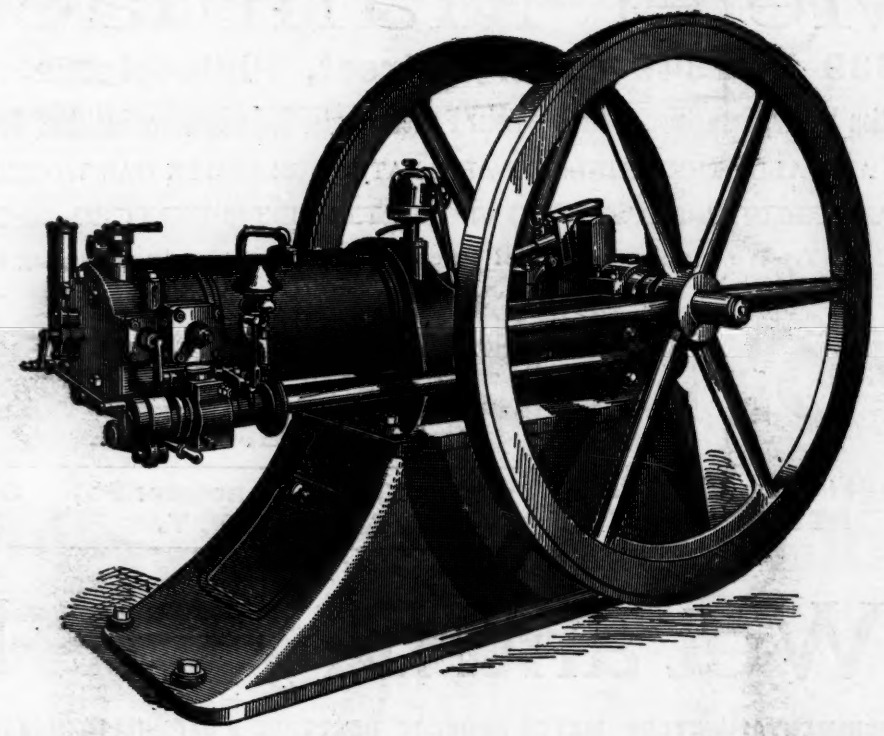

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